NOV 22 1941

ENGINEERING AND MINING JOURNAL

NOVEMBER, 1941

Mining copper in Chile Exploration Co.'s open pit at Chuquicamata. A 4-cu.yd. electric shovel loading 70-ton cars. See page 89.

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Employee Cooperation • Geology of the Powell Mine
Asbestos Milling in Quebec • Chromite in the Philippines
Controlling Reagents Automatically • Flotation at Duquesne
Screening Plant on the Marquette Range
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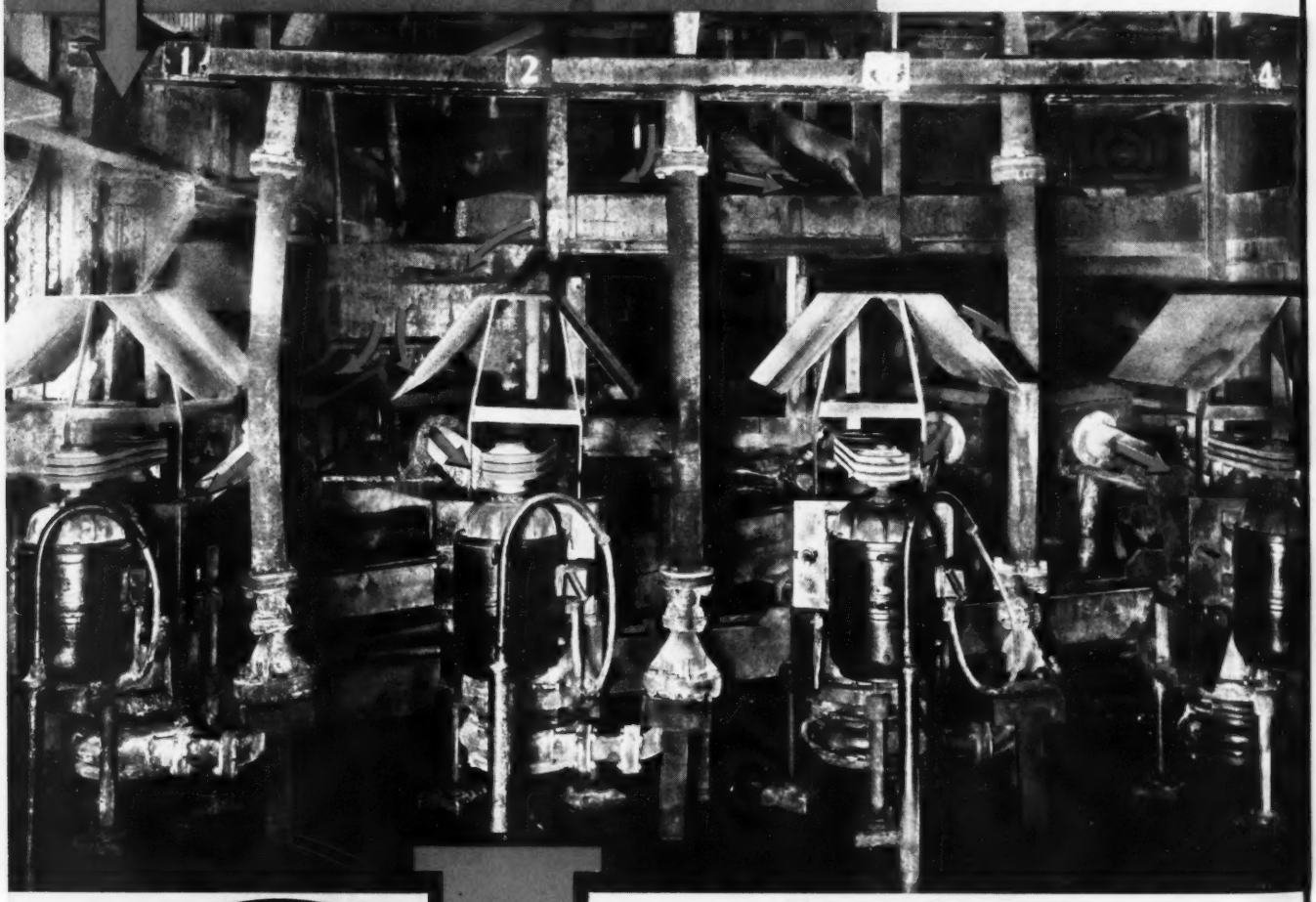
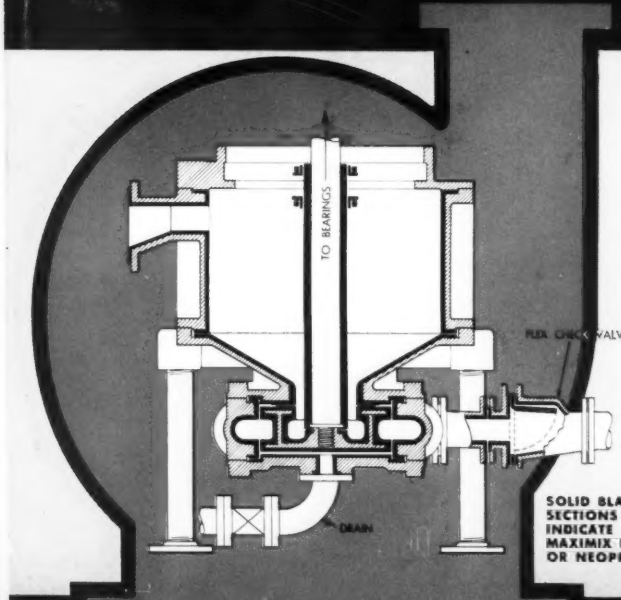
4 OF THE SIXTEEN → PACKLESS PUMPS

INSTALLED IN ONE PHOSPHATE PLANT





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Problems in drilling placer ground, both thawed and frozen, in Alaska for valuation purposes will be treated next month by L. H. Doheny. Topics include: Calculating the over-runs and under-runs, block and triangle valuation, and caisson sinking.

▼

Classification and hydroseparation play a part in connection with the floating and tabling of fines in the phosphate fields of the South. B. J. Larpenteur, metallurgical engineer, will deal with the subject soon, particularly respecting the hydroseparation operation conducted on the main volume of washing plant debris. A characteristic of the phosphate slimes appears to be that, almost regardless of detention time, a certain dilution must be used to separate a particular size.

▼

Evasée is a French word meaning "flaring outward," but in English engineering nomenclature it is used to denote an "expanding chimney." Thus, to quote from an article by Walter S. Weeks, to appear next month: "When a centrifugal exhaust fan is operating without an évasée on its discharge, the air flows to atmosphere at high velocity and its kinetic energy is wasted." Among other things, Mr. Weeks (professor of mining engineering at University of California) will discuss the conditions that call for an évasée.

▼

Also in December, an account of the development, production, and treatment of sylvite by the Potash Company of America, in the Carlsbad district, New Mexico, by R. A. Pierce and L. D. Anderson, assistant general manager and consulting engineer respectively. This company is one of the three operating in this area, the other two being United States Potash Co. and Union Potash & Chemical Co.

H. C. PARMELEE
Editor

ENGINEERING AND MINING JOURNAL

H. W. CLARKE
Vice-President

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COVER ILLUSTRATION: Mining copper in Chile Exploration Co.'s open pit at Chuqu.camata. A 4-cu.yd. electric shovel loading 70-ton cars. See also page 59. Photo by Fenno Jacobs from Three Lions

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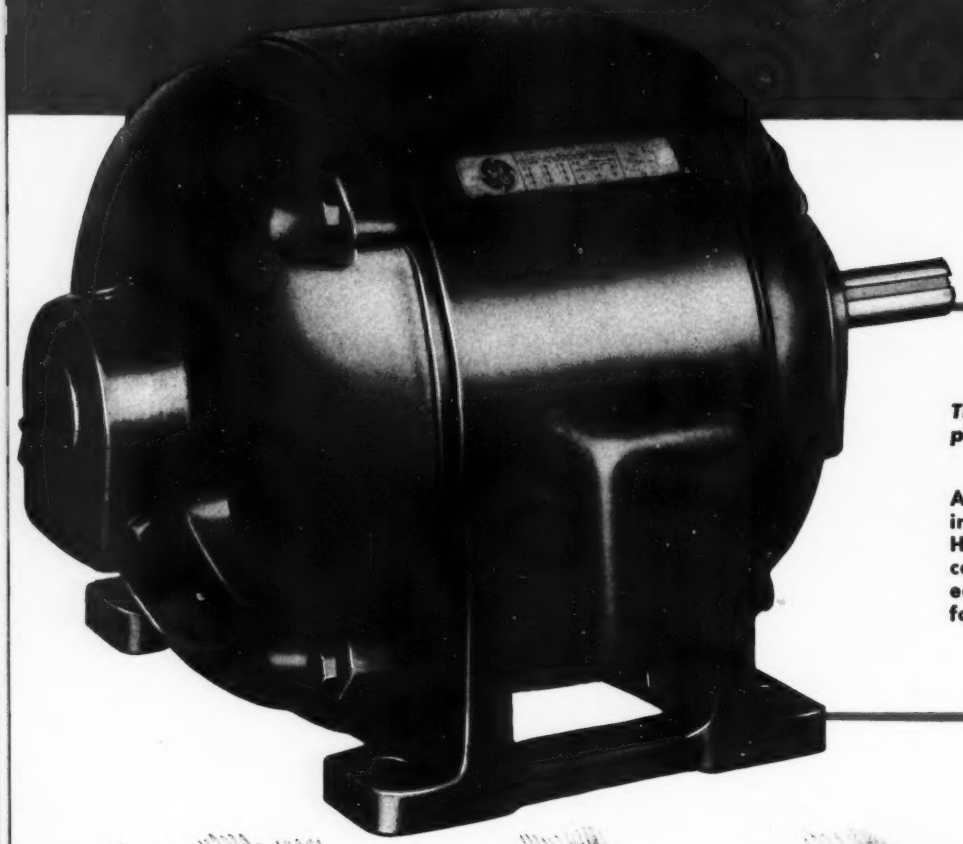

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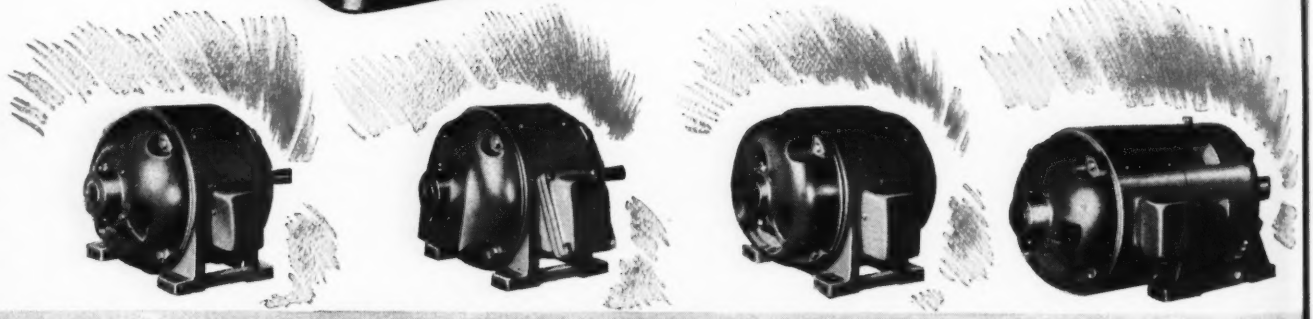

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Volume 142 NOVEMBER, 1941 Number 11

Defense Program Intensified

WASHINGTON threw the defense machine into high gear last month and intensified its drive to make the public aware of the menace of a Hitler victory and the necessity of directing one hundred percent of this nation's energy toward his defeat and destruction. The Administration threw overboard its last pretense of "business as usual"—a fond delusion to which the New Deal clung long after more practical minds knew the futility of such a policy. Indeed, the OPM Division of Priorities made it painfully apparent through its copper order that prohibition, not persuasion, is now the order of the day in the regulation of civilian industry.

For some time past the Administration has been concerned over the apathy of the general public toward the war, and has sought means of arousing the people not only to the dangers that threaten them but also to the necessity of really going "all-out" for national defense. The area of complacence seems to be in the central part of the country, comfortably removed from the Atlantic and Pacific seaboards and their attendant concentration of defense activities. Probably the great mass of the population of that region will come to a realization of the seriousness of the situation only when shortage of goods, closed shops, and unemployment strike their local communities. This country has yet to experience the "blood and tears" aspect of the war, but the necessity for sacrifice is upon us and will soon be felt in no small measure.

We doubt if mining men, wherever located, lack comprehension of the importance of the defense effort. They are too earnestly engaged in maximum production of metals and nonmetallic minerals to question the gravity of a situation that calls for more and ever more of their products. They are too busy coping with migration of their labor to defense industries, with the consequent necessity of training new men on the job and supervising their safety in unfamiliar work. As an industry, mining probably is closer than most others to its maximum effort twenty-four hours a day, and consequently senses the implication of the strain under which it labors. So it is not for the mining industry that the Administration is concerned, but for others that have not prepared for the impending impact of the defense program. For more than a year *Engineering and Mining Journal* has emphasized the progressive effect of defense on private industry and has forecast increasing disruption of normal business. Today we repeat the warning with the added thought that it is still impossible to foresee all that will be demanded of the American people before this national emergency is over.

What Price Zinc?

AFTER MAINTAINING THE PRICE of Prime Western zinc at 7¼¢ per pound, St. Louis, for a year, the OPA sanctioned on October 10 a rise of one cent per pound. The advance was long overdue, partly because a year ago the price was fixed arbitrarily and without knowledge of what it fairly should be, and partly because changing conditions made it increasingly apparent that a rise was necessary to the fulfilment of the defense program.

OPA's official announcement was enlightening: "This action represents a case where intensive study by the OPA staff has disclosed that a price increase is necessary to maintain and expand supply. Zinc and its ores are produced under a variety of conditions and there were a number of factors underlying this action, including the utilization of lower-grade ores and opening of new mines." The statement might equally well have read: "This action represents a case where intensive education of the OPA staff by the zinc industry has shown that a price increase is necessary to maintain and expand supply."

Without quibbling over credit for obtaining the increase, the action of OPA is a hopeful sign that a governmental agency, which can't be expected to know everything, can change its economic mind as a result of intensive study. Lead producers should take courage and look

forward hopefully to early action by OPA increasing the price of lead. It is true of that metal as of zinc that a price rise will be an incentive to increased production, both from new deposits and from lower-grade ores. Mineral in the ground is either valuable ore or worthless rock, depending largely on price. If OPA has learned this characteristic of the mining industry, its intensive study will have been well directed. Would that the State Department had been as apt a student when it negotiated the late lamented trade treaty with Canada.

Geology in Ore Discovery

ONE OF THE BEST SESSIONS of the recent meeting of the American Mining Congress in San Francisco was that devoted to the status of ore discovery in the Western States, with particular reference to the rôle of geology in finding new orebodies. Participating in the symposium was a blue ribbon panel of mining geologists. The occasion was noteworthy for the quality of the program, and significant in its relation to the future of the mining industry.

Although it will not do justice to the program, a summary of general conclusions may be recorded. First, chance still plays an important part in the discovery of new orebodies, particularly those that outcrop. Second, widespread and systematic geological investigations would probably lead to the discovery of new ore deposits, just as they isolated potentially productive areas in the early years of the petroleum industry. Third, geological knowledge and evidence are indispensable guides to exploration for new orebodies within developed mines. Fourth, intensive geological study of existing mines offers the best hope of expanding the productive areas of known mining districts, thus prolonging the life of the entire mining industry. Fifth, small mines are likely to suffer most from lack of geological study, which is unfortunate, because careful geological reasoning might develop small properties into large producers. Finally, large or small, new or old, all mines worthy of the name would benefit from detailed geological study.

Tinkering With the Census

IT IS NOT IMMEDIATELY APPARENT what is behind the Senate industrial census bill, S. 1627, and related House bills, but whatever the motive they should be quashed. They propose not only to change the frequency of the census of manufacturers from two years to five, which is bad enough, but also to authorize the Bureau of the Census to collect whatever additional "current and periodical statistical data" it deems desirable, which is vastly worse. For the mining industry this would mean duplication of the work of the Bureau of Mines, which now compiles such excellent data and reports on the mineral industries—a highly specialized task for which the Census Bureau is not equipped. Unless you want to be harassed with new and useless questionnaires on mineral production, you will ask your Senators and Representatives to kill S. 1627, H. R. 5139, and H. R. 5232. They bode no good for industry in general or for the mining industry in particular.

Who Is a Saboteur?

APPARENTLY PURSUING A POLICY of rule or ruin, John L. Lewis last month gave an exhibition of contemptuous arrogance that must have been offensive to good citizens. Defiant toward the President and disdainful of the welfare of the country, he halted bituminous coal production in steel companies' mines, curtailed steel production for a few days, and otherwise reduced the speed of the defense program. None of his acts was necessary to enable labor to gain its legitimate ends; all were calculated to inflame the public and turn it against his cause.

A bewildered public must be asking itself some perplexing questions. What is the essence of patriotism, and who is a patriot? Conversely, what is the character of sabotage, and who is a saboteur? We don't mean legally or in any technical sense. We mean morally, in the estimation of intelligent men of good will. Are industrialists the only ones who must be pilloried because they don't "cooperate" with the New Deal? Or would blind Justice also put a curb on insolent labor leaders who run amuck under the protection of the National Labor Relations Act and its administrative agency? Is Myron C. Taylor the symbol of wilful obstruction to the defense program? Or is John L. Lewis the haughty dictator of what may or may not be done in the United States? Mr. Lewis seems a saboteur as much as though he were a secret agent of Hitler, paid to incite dissension and strikes among American workmen. Incidentally, he is also the pampered product of an Administration that continues to reap the results of its unfair and partial labor policies. Some happy day the pendulum will swing back again toward a more stable relationship between employer and employee; and more enlightened, less belligerent men will lead labor toward its legitimate goal.

Reflections from Washington

By Special Correspondent

ALLOCATION OF METALS has begun in earnest. The OPM copper order issued Oct. 22 sets up drastic restrictions as well as an allocation program. Like action is to be expected in due time for other scarce metals. It is extremely important, therefore, to understand the philosophy as well as the wording of the order.

The priorities program works only when the shortages experienced are a small percentage of the total requirement for a metal. It functions smoothly then to provide an orderly arrangement that decides who waits a bit before he gets his wanted supply of material. But the priorities program breaks down completely when a shortage reaches the proportions of 20 or 25 percent. This is especially true when modest shortages grow month after month until practically complete interruption of flow for many normal uses must be faced and readjustment arranged.

Official Washington, particularly Donald Nelson, now in charge of priorities, is not surprised by this situation. It was anticipated. The copper allocation and curtailment program has, therefore, been long in the making.

Zinc and Lead Rules

GRADUALLY the control of zinc, lead, and other non-ferrous metals is being tightened by Washington. Only occasionally do these industries find some measure of relief. The most comforting of these latter measures was the decision of OPA to permit an advance of a cent a pound on zinc to meet higher costs in the industry. The advance was from 7.25c. to 8.25c. for Prime Western and from 8.25c. to 9.25c. for "High-Grade" zinc. Comparable advances were made for other grades, with customary trade differentials applicable to various transactions. Administrator Henderson in announcing the lifting of the ceiling said:

"This action represents a case where intensive study by the OPA staff has disclosed that a price increase is necessary to maintain and expand supply. Zinc and its ores are produced under a variety of conditions and there were a number of factors underlying this action, including the utilization of lower-grade ores and opening of new mines."

Recognition of the incidental nature of certain secondary-zinc operations was also given by releasing secondary zinc, zinc oxide, and zinc dust from requirement of contribution to the pool which previously had applied to the secondary as well as primary materials. The main objective in all these zinc activities is to stimulate production. It is hoped in Washington that the new prices and the leniency on secondary metals will result in increasing available supplies of zinc by 10 to 15 percent.

The complete priority regulation of lead announced on Oct. 4 has been worked out with the hope that slight deficiencies in supply for "essential" civilian needs may be eliminated. Nonessential civilian applications are going to be cut off almost altogether as soon as needed information is gathered.

Increases in pool operations on lead require diversion of 15 percent from November refined production. It is hoped that the huge consumption anticipated in 1942 can thus be met, even when defense manufacture achieves full speed.

On Nov. 4, Leon Henderson spiked all rumors of a higher lead price. He declared that "evidence accumulated by OPA clearly indicates that a large part of the mining industry is in a position to increase its output of lead at the present price."

The Copper Order

THE COPPER ALLOCATION ORDER officially published in the Federal Register on Oct. 22 does three things:

1. It provides for immediate conservation of copper, the amount to be used by a manufacturer being determined in some fixed ratio to the consumption in 1940.

2. It prohibits any use of copper after January 1942 for many purposes.

3. It provides for allocation of copper for the more urgent defense uses, with definitions of these indicating the degree of urgency judged to apply at the present time.

Copper users are urged to note that permissible usage in the near future does not guarantee supply. For example, automobile manufacture may go on to the extent of 50 percent of last year's rate only if the companies can get their materials.

The building program of private operators who are not doing construction for defense projects is even more severely restricted. Practically speaking, copper will be available for house construction only to provide electrical conductor for the wiring system. In fact, copper sheet, strip, and screening is not to be used after Nov. 1 of this year in connection with building construction except for minor repairs or maintenance where the existing installations are of comparable metal.

Export of Facts

CONTROL of the sending of information out of the United States is established as a part of the Export Control program. For example, if a mining engineer has drawn some plans for a new plant or mill, they may go out of the United States only under license if they relate to any industry where the commodity would require license for export. As most important metals and minerals do require export licenses, this means that most mining information that is not of a published form is similarly restricted.

Three varieties of licenses are granted: The first is a blanket license which is given to a parent company to permit unrestricted shipping of information to a subsidiary. But even under this license a monthly report is required. In the second place, a general license is issued to cover the general sending of information to certain countries such as Great Britain, its Dominions, and China. The United States does not wish to restrict the sending of information to these friendly destinations; but a monthly report of the sendings is required. The third class is the special license which is granted for individual shipments of information. Presumably a set of mine plans sent by a consulting engineer to a client in Latin America would be handled under such license.

Washington knows that much information is going out by mail and otherwise contrary to the Export Control regulations. The officials principally concerned are, therefore, urging that executives and engineers of mining enterprise watch this matter more closely. They say, "In case of doubt, submit an application." If a license is not required there will be no long delay in determining this fact. If a license is not sought and obtained when it should be, there might be serious penalty. That would be particularly true if, even unwittingly, American firms were sending information to "blocked" nationals. These blacklisted individuals and firms are not eligible to get anything of a restricted nature. A license is never granted for the sending of unpublished matter to them.

Labor Appeasement

WASHINGTON, during all of October, had been increasingly indignant at certain labor leaders. Even those sympathetic with the broad principles of unionization felt that there had been gross abuse of the tolerance and patience of officials. Controversies between A.F.L. and C.I.O. had brought about a number of intolerable situations. It was generally believed, late in October, that before November was very old drastic official action would be taken in these matters.

First there is likely to be a further order issued by the President. This will carry forward one step further the OPM appeal of Oct. 22. It may go so far as to demand no more strikes in defense industries under any circumstances.

If the President does not act with sufficient force to prevent work interruptions at important shipbuilding and munition establishments, Congress is sure to take a hand. And if Congress gets under way in this matter, it is certain to go much farther than the labor-favoring executives desire. Even the more radical union spokesmen in Washington are, therefore, hoping that they can control the irresponsible local groups promptly. If they cannot, there

will be a serious setback through mandatory legislation. Many think that this legislation will go so far as absolutely to forbid strikes during the national emergency.

Change of Pace

THE OCTOBER SPEED-UP of defense manufacture reflects a fundamental change in strategic policy. Uncle Sam had two choices. He could make an intensive military effort with fair chance to lick Hitler in two years. He could make more deliberate preparation, with certainty of winning with Britain in ten years. The decision was for the two-year plan.

Russian resistance to the Nazis was probably the last large weight throwing the balance toward the short, intensive war program. Russia's unexpected success in resisting mechanized armies after extensive initial victories heartened British and American strategists tremendously. They conclude that the Allied forces fighting on the European Continent are already sufficient in numbers to beat Hitler. The job of Britain and the United States is to munition this huge military aggregation *now*.

Undoubtedly American business will suffer less in a two-year all-out effort than in a ten-year program, with its huge aggregate of losses. But, even so, the more drastic nature of the immediate actions necessitated by intensive war plans could not be overlooked by officials. Political hazard was high. The stake was great enough to take a chance, Washington has decided.

How Near to War?

CONSIDERATION of the copper order makes clear the realistic judgment of at least a part of official Washington. SPAB, the top policy-making agency, has decided that for all practical purposes the United States is at war. On no other basis could that agency justify a regulation which may put out of business large numbers of manufacturers.

Other equally drastic actions are expected. And not all of them will relate to material supply. Others will function with equal force in the areas of labor, taxes, prices and to influence (if not to control) almost every other economic factor of importance to mining.

This does not mean that Washington is making any guesses as to when official trigger-pulling begins. In fact, Washington more and more believes that the United States will be in a state of war, as a matter of fact, and may go on many months in this condition without any Congressional "declaration." Congress shouts valiantly that it alone can declare war. But privately a large number of the members of Congress will be delighted if they are not forced to vote on that question until long after everybody knows that the United States is "in."

One major potent argument is commonly heard for war declaration soon. Outstanding statesmen of this country and from abroad agree that such action would have an important benefit in the field of morale. It would encourage Britain tremendously. It would alleviate slightly the distress of conquered countries. It would crystallize American sentiment back of the war program. It might even start a few cracks in the morale of the German people; it would almost certainly do so in some other Axis areas, notably Italy.

But a declaration of war against Germany by the United States would have tactical disadvantage, military leaders believe. They fear that it would force an undue concentration of military reserves in the Pacific, lessening our aid to Britain. They think thus, as it might touch off the Oriental powder keg. In general, the military leaders oppose active participation by the United States in any military operations at this stage.

There is little necessity, or advantage, in any attempt to weigh here the pro and con factors. The fact is that declaration of war would have little or no influence on the way in which the government will proceed during coming months in control of materials, procurement of metals, and doing of other things which affect the mining industry. For all practical purposes the mine executive and engineer can proceed on the assumption that *we are at war*, and his judgment will be soundly guided.

Mineral Stockpiles

SUBSTANTIAL PROGRESS has been reported by the RFC in accumulation of foreign mineral supplies for its stockpiles. Up to mid-September commitments for all stockpile purchases were $1,100,000,000. Of this commitment the largest single item was for rubber. But the aggregate of commitments for minerals and metals was approximately $880,000,000; that is, about 80 percent of the total.

Commitments as of Sept. 13 are announced by RFC for mineral commodities as follows: Refined tin, $207,500,000; tin ore, $122,434,000; aluminum, $180,034,000; copper, $140,110,000; tungsten, $113,169,000; manganese ore, $41,766,000; lead, $31,819,000; chrome, $12,015,000; antimony, $6,403,000; zinc ore, $3,843,000, and various other metals. All of these were purchases by Metals Reserve Co. In addition, Defense Supplies Corp. has ordered the expenditure of $3,200,000 for nitrate of soda from Chile. This same corporation has also made commitments for industrial diamonds and diamond dies.

The percentage of these strategic and critical materials which were either delivered or actually afloat is also reported as of mid-September. Figured on a commodity basis (not on the dollar basis) the RFC states that its success has been about as follows: Copper, 50 percent; lead, 40 percent; chrome ore and antimony, 25 percent; refined tin and manganese ore, 20 percent; nitrate of soda, 10 percent; zinc ore, tin ore, tungsten, from 8 to 5 percent approximately.

In all of this report, data refer only to RFC activities. They do not include Procurement Division (Treasury) nor Army and Navy buying or stockpiling, nor are private stocks included.

Some further rather broad commitments are also in the making, or recently perfected with Latin American countries. These provide that these neighbor nations will not export the strategic materials except to the United States or with the United States' consent.

News "Fines"

Wage-Hour Records—A few companies are being granted authority to maintain simplified payroll records when subsequent calculation can readily be made in case of official inspection to determine compliance with the law. It is hoped that these exemptions will eliminate much detailed work without preventing both compliance and convenient checking by government inspectors.

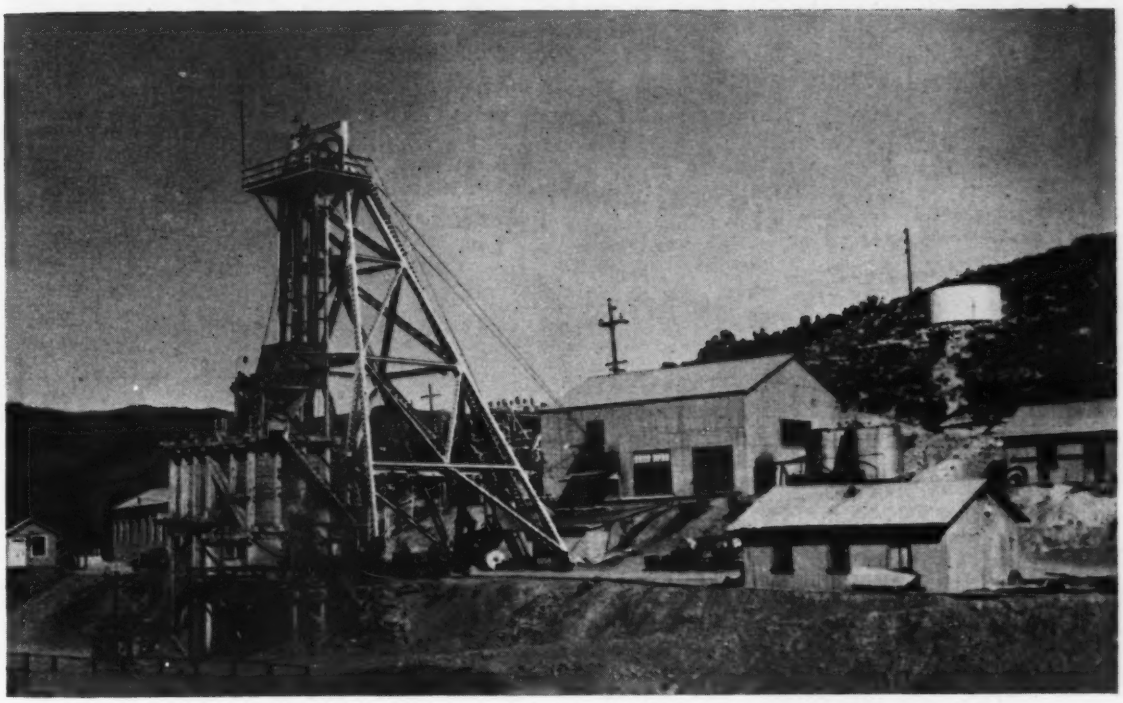
Alabama Graphite—Small-scale flotation tests of weathered schists containing graphite have led the Bureau of Mines to a favorable report, made jointly with the Geological Survey of Alabama as its Bulletin 49. If commercial operations confirm these trials, it appears that domestic supply of a flake graphite of the kind hitherto available only from Madagascar may be established.

Changes in Tariffs—Two important tariff actions affecting minerals occurred in Washington during October. Mining State representatives were able to defeat the Administration effort which would have eliminated tariff duties on strategic minerals and metals when bought by the RFC subsidiaries. Thus, the protected status of these materials continues. The second action was the promulgation by the State Department of the new reciprocal trade agreement with Argentina. In it the ad valorum duty of 25 percent on beryllium oxide and carbonate was cut in half; but the anticipated cut in tungsten ore tariff was not made. Spokesmen of the mining industry call this "an important victory."

Priority Penalties—The first serious priority crackdown was made in October, against a Chicago aluminum castings company. That firm is to be deprived of its raw material until March 31, 1942, in punishment for shipping fabricated products for civilian use, which is alleged to have been contrary to official orders.

Profits Control—Some time next year there will undoubtedly be increased restriction on profits. But even Secretary Morgenthau when he proposed the 6 percent limit did not have any naïve idea that Congress would enact a law of so sweeping and so simple a form as he first suggested. When profits restrictions are imposed they will be arranged in the form of a tax bill. Presumably that will be the first Revenue Act of 1942.

Alcoa Exonerated—Aluminum Company of America won an important decision in Federal Court last month when it successfully resisted the Government's suit charging monopoly, conspiracy, and price fixing. This ends a four-year-old anti-trust action by the Department of Justice in which the Government has been defeated at every turn. Appeal, of course, will be made to the Supreme Court.



Caselton shaft, 1,500 ft. deep, the center of Combined Metals' underground operations

PIOCHE TODAY

A picture of current operations in Nevada's 75-year-old camp

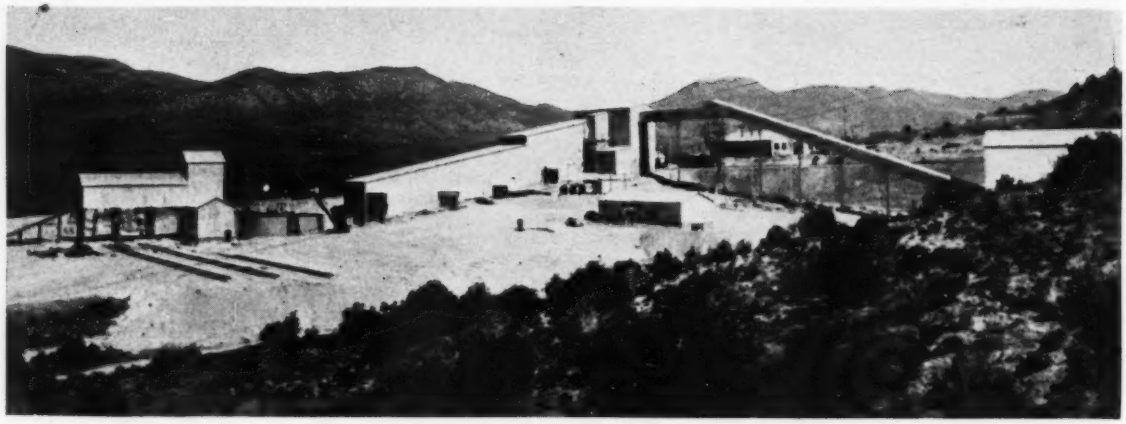
John B. Huttl
Assistant Editor

THE LIFE OR CAREER of a mining district resembles very much that of an individual. Few camps illustrate the vagaries of life more completely than has Pioche, in Lincoln County, southeastern Nevada. The town and principal mines lie in the Pioche Mountains, a southeast-northwest range about 15 miles long and a mile wide, lying between Duck Valley on the north and Meadow Valley on the south. Elevation of Pioche proper is about 5,800 ft., and the highest point of the range rising to 7,150 ft. is Mt. Ely. The district is now served by good roads and railroad connections, which assure transportation of machinery, supplies, concentrates, and ores at a reasonable cost. It is accessible by improved highways either from Ely, some 108 miles north; from Las Vegas, 195 miles south; and from Cedar City, Utah, via Panaca, 95 miles east. A branch line from Caliente, a station on the main Union Pacific R. R. line 26 miles south, leads to Pioche, with several spurs serving the principal producers.

Pioche is a relatively old camp, the earliest discovery of mineral having been made by soldiers of General Connor in 1862. Active development and exploitation of known orebodies did not begin until 1869, when F. L. A. Pioche, William H. Raymond and John H. Ely entered the district and respectively formed the Meadow Valley Mining Co. and the Raymond & Ely Mining Co., which became the principal producers of that era. Early production came from rich fissures in the quartzite hill south of Pioche, from which a production of more than $16,000,000 was taken from 1869 to 1875.

Activities subsequently declined because of decreasing silver values in the fissures and heavy flows of water in the deeper workings, and operations were carried on chiefly by leasers. Discovery of some rich contact orebodies along the Yuba dike around 1890 brought about another period of activity, followed by one in 1907, which culminated in the establishment of the Prince Consolidated property as a producer. A period of relative quiet followed, and it was not until the development of the large bedded deposits of the district that a real revival of activities set in. One of the chief leaders in this work was the Combined Metals Reduction Co., headed by E. H. Snyder. The company holdings were thoroughly prospected by both churn drilling and underground development, and a large tonnage of lead-silver-zinc sulphide ores was subsequently blocked out. Among the smaller producers in the district, the Prince Consolidated, headed by the late David Gemmill, was a shipper of low-grade oxidized silver-lead-manganese-iron fluxing ores for years.

Additional factors responsible for the come-back of Pioche are the perfection of selective flotation, cheap electric power from Boulder dam, and the improved transportation facilities mentioned previously. The Boulder dam power line was completed in summer of 1937. Average power cost is 6½ mills per kw. hr. The new 500-ton flotation mill of Combined Metals, now nearing completion, undoubtedly will result in the reopening of many of the smaller producers. In fact, the



Combined Metals Reduction Co.'s new 500-ton flotation mill at Pioche. Crushing plant at right. Filter plant at left. Out of picture on the higher ground to the right is the Caselton shaft

property of Prince Consolidated was scheduled to start production some time ago.

Center of the Combined Metals operations which I visited recently is the Caselton shaft. It is a vertical opening 1,500 ft. deep, and about four miles by road from No. 1 shaft, leased by the company with some ground from Amalgamated Pioche Mines & Smelter Corp. Underground distance between the two shafts is 8,200 ft. Each of the four compartments measures 4x6 ft. inside the timbers, and the hoisting equipment consists of a 250-hp. double-drum hoist with 5-ton skips. The company ground is on the west end of the Panaca claim, beyond the fault which cut off the rich Raymond & Ely vein in the quartzite. The ore occurs in a limestone bed or channel running in an east-westerly direction from 40 to 50 ft. thick and up to 450 ft. wide covered by impervious shale and resting on a siliceous, micaceous shale directly above the quartzite. On a second channel, known as the northwest, lies the Prince Consolidated property about 7,000 ft. south of the Caselton shaft. Fig. 1 shows a cross-section of a typical bed under exploitation. It consists of what is locally termed as upper bed from 1 to 30 ft. thick, with a heavily mineralized band at the lower part, followed successively by 4 to 5 ft. of shale, 3 ft. of mineralized matter, 2 ft. of rib, and the 1½-ft. of footwall bed. Block faulting, involving vertical throws of more than 100 ft., is very common. In one instance, a throw in excess of 3,000 ft. has been encountered. The mined ore is a typical complex sulphide, consisting of galena, sphalerite, and pyrite. Past shipments have averaged 0.035 oz. gold; 6.56 oz. silver; 6.25 percent lead; 16.1 zinc; and 17.8 iron. Sulphur content is 28 percent. The limestone contains carbonaceous matter and about 30 percent insoluble.

A simple, non-scale layout of the current underground workings is shown in Fig. 2. The No. 1 shaft, equipped with a 150-hp. double-drum hoist, is 1,400 ft. deep, and contains two compartments. It is connected with the Caselton shaft through a raise fitted with hoisting facilities, known as the 1,410, between the 1,200 and 1,400 levels. Another connection is the 1,411 raise between the 1,300 and 1,400 levels, and the one between the 1,200 and 1,300 levels. Development drifts measure 5x7 ft, in cross-section, and haulage drifts 8x8 ft. Pneumatic drills—that is, drifters, jackhammers, and stopers—are used. Steel includes 1⅛-in. round, hollow, ⅞-in. hexagonal, and 1-in. quarter-octagon. Bits are forged on. The drill round put in in development drifts consists from eight to twelve holes placed in hammer cut fashion. Blasting is done with 40 percent gelatin dynamite and electric blasting caps. The ore is easy to drill and breaks readily. Loading of development rock is done mechanically, loaders being available underground. Exploitation of blocked-out ore is effected by room-and-pillar methods similar to those employed in coal mines, with the exception that no standard room-and-pillar dimensions can be laid out, owing to the faulting. Pillars are mined on retreat.

Under normal conditions exploitation of the bed proceeds in two operations. The upper bed is mined first, and the ground subsequently allowed to cave, followed by removal of the footwall bed, including the rib. The rib material is sorted if too low in grade. In sections where the lower part of the upper bed is thin, all material from the lower bed to the lower part of the upper bed is taken out in one operation by square-set stoping. About 12 percent of the material broken in the stopes is moved to transfer points by mechanical scrapers, the remainder by wheel-

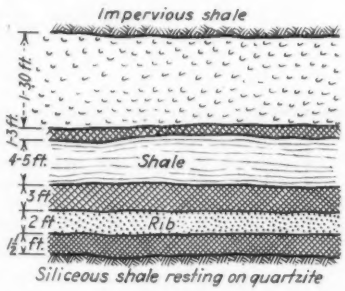


Fig. 1 . . . Cross-section of a typical bed under exploitation by Combined Metals Reduction Co.

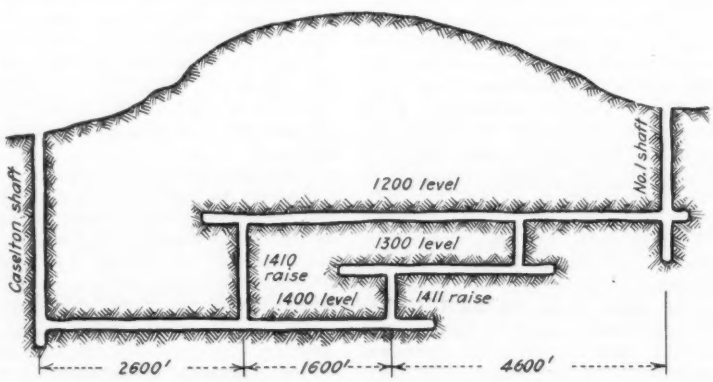


Fig. 2 . . . A sketch of the underground workings in the Combined Metals property. Not to scale

barrows and 1-ton end-dump cars. Haulage is one by storage-battery locomotives (three 7-ton, one 5-ton, and four Manchas) and 3-ton side-dump cars. Track gage in the Caselton area is 24-in., and that in the No. 1 shaft workings 18 in. In the main haulage drifts 35-lb. rails are used; 12-lb. rails are laid in the stopes. Because of the spotty nature of the ore and fluctuating concentration of minerals, much sampling is required. On the average, 3,500 samples are taken a month, with two samplers employed on day shift. Grab sampling is practiced exclusively.

As the mine makes considerable water (about 2,150 g.p.m.), the pumping plant is correspondingly large. It includes five deep-well pumps on the 840-ft. level, and three centrifugal booster pumps delivering to surface. Ventilation is mechanical, the major units being two 30,000-c.f.m. blowers. Portable blowers are used for auxiliary work. Electric power is taken from the main Boulder dam power line at 69,000 v., and stepped down to 2,300 and 440 v. by a modern transformer station near the Caselton shaft. Grouped around this shaft are a drill sharpening and repair shop, timber-framing and carpenter shop, change house, and mine office. The air compressor equipment is housed in the hoist house.

The 500-ton mill under construction on a gently sloping site just below the Caselton shaft was about 75 percent completed at the time of my visit (early in June). In construction and layout it establishes a new standard in mill design. The complete mill consists of a separate crushing plant capable of handling more than 100 tons per hour, a grinding and flotation unit, and a filtering plant. The thickeners are in the open between the mill building proper and the filtering plant. The flowsheet follows closely that at the company's concentrator at Bauer, Utah, and treatment will involve crushing to minus $\frac{3}{8}$ in. in three stages, grinding to flotation size in a large ball mill operating in closed circuit with a mechanical classifier, flotation, and thickening and filtering of concentrates.

Outstanding features in the mill design are the absence of windows in the various buildings, heavily insulated building walls, artificial ventilation to reduce temperature changes to a minimum, and fluorescent lighting in the flotation section. Another feature is the total absence of elevators, all materials being transported by belt conveyors. Other buildings of similar construction near the mill site are a large warehouse, office, assay office and laboratory, and several dwellings for married members of the staff. Operating officials at Pioche include R. L. Dean, superintendent, and W. H. Kelsey, chief engineer, in charge of mill construction.

Valuation of Future Profits With Variable Annual Income

A method for estimating them under this condition is set up

C. E. Mills

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IN DETERMINING the cash value of a mine or property for sale or for tax purposes it is common practice with engineers to estimate the future expected net operating profits and to discount to present worth by use of the Hoskold discount factors. Salvage value of the plant at the end of the life of the property may be added and consideration given to future plant expenditures in arriving at the final present worth or cash value of the property.

The Hoskold factors were first expounded by H. D. Hoskold in "Engineer's Valuing Assistant" (London 1877), and may be found in accountants' handbooks such as Grimes and Craig on "Principles of Valuation," Hoover's "Principles of Mining," and other textbooks. Hoskold factors are based on uniform annual profits, and are tabulated for various rates of return on the investment, with the balance of the annual income set up in a sinking fund each year to return the capital investment at the end of the life of the property. The usual rate of interest for underground mines is 8 percent, with a 4 percent sinking fund. Rate of return on the investment naturally varies with the risk involved in the operation of the property, and may be varied somewhat according to the engineer's prediction of future operating costs and of metal prices used in calculating future profits. Although Hoskold's tables usually give factors based on a wide range of interest rates, they are limited to sinking-fund rates of 3 and 4 percent. These two rates are somewhat high with the present value of money.

Hoskold's discount factors cannot be used when operating profits are not uniform throughout the life of the property. The following method is set up to show how the present value of future operating profits may be determined regardless of whether the annual return on the investment is uniform each year or variable by years.

Assumptions

Total operating profits	$50,000
Life of property	10 years
Return of investment	6 percent
Interest rate on sinking fund	3 percent
V = Present value = To be calculated.	

Each year $0.06V$, or 6 percent of the capital investment, V, will be deducted from the annual return, and the remainder of the annual return set up in a sinking fund at 3 percent to equal V, or return the amount of the capital investment at the end of the life of the property. See the table at the bottom of the page.

The sinking fund over a ten-year period must equal the capital investment or the present worth of the operating profits.

$$\$59{,}449.83 - 0.68783274\,V = V$$
$$\$59{,}449.83 = 1.68783274\,V$$
$$V \text{ or present worth} = 35{,}222.58$$
$$\text{Discount factor} = \frac{\$35{,}222.58}{\$50{,}000.00} = 0.704452$$
$$\text{Hoskold factor for uniform profits} = 0.67921$$

If the first column of annual income is set up at a uniform rate of $5,000 annually and the above calculation carried out, the final value will be $33,960.50, and the discount factor $33,960 divided by $50,000 gives 0.67921, which is the Hoskold factor for these rates of interest and a ten-year period.

Year	A: Annual Income Less Return on Investment	B: Compound Interest Factors	Products A × B or Sinking Fund
1	$8,000 − 0.06 V	$(1.03)^9 = 1.304773$	$10,438.18 − 0.07828638 V
2	$8,000 − 0.06 V	$(1.03)^8 = 1.266770$	$10,134.16 − 0.07600620 V
3	$7,000 − 0.06 V	$(1.03)^7 = 1.1229874$	$8,609.12 − 0.07379244 V
4	$6,000 − 0.06 V	$(1.03)^6 = 1.194052$	$7,164.31 − 0.07164312 V
5	$6,000 − 0.06 V	$(1.03)^5 = 1.159274$	$6,955.64 − 0.06955644 V
6	$5,000 − 0.06 V	$(1.03)^4 = 1.125509$	$5,627.54 − 0.06753054 V
7	$3,000 − 0.06 V	$(1.03)^3 = 1.1092727$	$3,278.18 − 0.06556362 V
8	$3,000 − 0.06 V	$(1.03)^2 = 1.0609$	$3,182.70 − 0.06365400 V
9	$2,000 − 0.06 V	1.03 = 1.03	$2,060.00 − 0.06180000 V
10	$2,000 − 0.06 V	1.00 = 1.00	$2,000.00 − 0.06 V
	$50,000		$59,449.83 − 0.68783274 V

Chromite in the Philippines

Spurred by emergency conditions, the Islands' production is mounting rapidly

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Manila, P. I.

Mining a chromite lens on surface at Acoje

CHROMITE MINING in the Philippines is relatively new. Prior to 1933 little interest was taken in occurrences of this ore in the Islands. In an information circular of the U. S. Bureau of Mines issued in 1932 and devoted to chromite, Philippine chromite was not mentioned. A different attitude is displayed by the Minerals Yearbook of 1939, wherein it is pointed out that the Philippines have become an important producer. This is definitely shown by imports of chrome ore into the United States. During 1940 out of a total of 657,689 tons, 156,566 tons, or about 22 percent, is credited to the Philippines. The Islands rank second among the six principal suppliers for the United States, being exceeded only by Africa.

The growth of Philippine chromite mining appears in the accompanying table and graph of exports from 1935 through 1941:

Table I—Philippine Chromite Exports 1935-1941

Year	Exports, Metric Tons
1935	1,292
1936	11,890
1937	69,855
1938	66,911
1939	126,749
1940	190,958
1941 (estimated)	400,000

Obviously, a great expansion has taken place in Philippine chromite mining since the outbreak of war in 1939. Prior to 1939, Philippine chromite was not too highly regarded, on account of the long ocean haul, general skepticism of the size of the orebodies, and certain shortcomings of the ore that made it less attractive than chromite from Turkey or Rhodesia. During the pre-war period both Japan and Canada acquired fair amounts of it, and Japan was practically the only market for ore that was poorer than the customary metallurgical grade (48 percent) but above the refractory grade. Since export control measures were imposed in the Philippines, all exports of chrome ore to Japan have been prohibited.

The record of exports is not as good as it would appear, as approximately half of the tonnage (400,000 in 1941) represents ore below 35 percent chrome, or so-called refractories ore, which at present is unsuited for metallurgical use. This comes entirely from the great chromite deposit at Masinloc, Zambales.

The remaining 200,000 tons, approximately, is high-grade, 48 percent Cr_2O_3 or higher, and either is taken by the metallurgical and chemical trade of the United States or goes to the Government stockpile. By far most of it comes from the deposits of Acoje Mining Co. in Zambales. A small tonnage is supplied from Dinagat Island, north of Surigao, and some 14,000 tons has been shipped from a new field in Oriental Misamis, Mindanao, with the prospect of larger amounts coming from this area in 1942. These fields are indicated on the sketch map, with some of the other areas as yet virtually undeveloped.

Chromite is usually found in ultrabasic igneous rocks or their metamorphic equivalents. It is essentially a constituent of peridotite and derived serpentine, of which great masses exist throughout the Philippines, and in every occurrence the chromite is associated with the latter. The chromite occurs as lenses of solid ore, or as fine disseminations in the rock, from which it can be separated and concentrated by crushing, grinding, and tabling. There are considerable amounts of "wash ore" as well, which appears to be residual in character, and has resulted from weathering of the original chromite-bearing material, with concentration of the chromite sands which often extend in long ribs across the surface. In one instance, I noted these sands exposed by trenching for a depth of 30 ft. They could be concentrated about 2:1 by simple washing to yield a high-grade product.

M. E. Hubbard describes another type of deposit in the Philippines which he calls the "pebble" type, which has resulted from weathering in a matrix of serpentinized peridotite. This, he says, frequently produces large areas of so-called float which has disappointed prospectors in failing to disclose any ore in place.[1]

In size, the chromite lenses vary greatly, in most cases tending to be small, with no sharp line between the ore and the peridotite or serpentine wall rock. In other words, the limits of the ore are economic rather than structural. Occasionally the orebodies are of substantial proportions. At the Acoje mine, lens No. 2 has been developed 400 ft. along the strike by tunnels driven *en echelon*. Lens 16 on this property is believed to extend at least 200 ft. in depth and has been mined for 100 ft. in length and 45 ft. in width on one level. Lenses are generally found in line something like sausage links, and prospecting for new ones is usually directed along an established line of strike. This characteristic is also noticed in the promising new chromite area in Cagayan, in Mindanao, hundreds of kilometers south of Zambales. Here the lenses tend to reoccur along a definite strike line, with barren serpentine between.

Where chromite is of high grade—that is, exceeding 48 percent Cr_2O_3—

[1] *Eng. & Min. Jour.*, August, 1937.

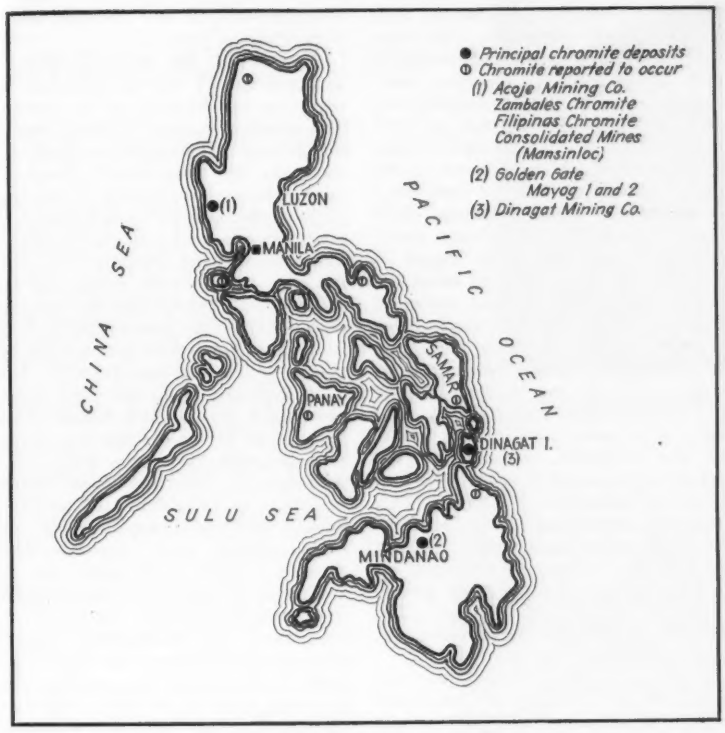


Fig. 1 . . . Sketch map of the Philippine Islands showing the location of the principal known chromite deposits and others reported to occur

the fact does not necessarily imply that it will be acceptable as metallurgical ore. Specifications of the Treasury's Procurement Division as originally set forth called for a minimum of 48 percent Cr_2O_3, not over 0.2 percent phosphorus and 0.5 percent sulphur, and a chrome-iron ratio of 3:1. It was further provided that the ore should be furnished in lumps to pass a 6-in. screen, and that not more than 10 percent should pass a ½-in. screen.

These requirements were later eased. In particular the allowable chrome-iron ratio was reduced so that 2.5:1 was acceptable, and chrome fines were not penalized to the extent that a shipment otherwise up to standard would be refused because it was not all lump. This action was probably taken because of the defense emergency, and it is not certain that it will be continued indefinitely.

Readers should note that a chromium-iron ratio of 3:1 does not mean a Cr_2O_3:FeO ratio of 3:1, as sometimes assumed. What is meant is the ratio of metallic chromium to metallic iron. Assays are almost always reported in terms of the oxides, and this leads to confusion. For instance, a chrome ore assaying 50 percent Cr_2O_3 and 16 percent FeO has actually a Cr-Fe ratio of 34: 12.4: or 2.7:1, instead of over 3:1 if calculated on the basis of the oxides.

Philippine ores of metallurgical grade rarely exceed a 3:1 chrome-iron ratio, although some deposits have furnished first-class ore. Some typical assays from several producing areas are recorded in Table II.

For comparison, four analyses of chromite ores from various producing countries[2] are recorded separately in Table III.

Here in western Mindanao a chromite lens is being worked

Chromite is characteristically brittle, but much Philippine ore is friable as well and may break up into fines after repeated handling, though mined as good lump ore. Attention is now being given to the problem of briquetting the fines.

Quite different in character from the metallurgical ores is the huge deposit at Masinloc of the Consolidated Mines, Inc., operated by the Benguet Consolidated Mining Co. on a profit-sharing basis. This deposit is considered the largest of its kind in the world. The ore occurs on a hill 150 meters high and 300 meters in diameter. Underground development and sections based on extensive diamond drilling show it to constitute a single orebody containing 10,000,000 metric tons near the surface. The chromite, which is massive, is a high-alumina chrome-spinel.[3]

An analysis of the ore, which is remarkably uniform in character, is given as follows, representing averages for production in recent years: Cr_2O_3, 33.6 percent; FeO, 14.8; SiO_2, 3.66; Al_2O_3, 30.16.

The ore is suited for refractory purposes and has been sold to manufacturers in the United States. Before the war, shipments did not exceed

Table II—Typical Assays of Philippine Chrome Ores*

Mine	CR_2O_3	FeO	Cr-Fe Ratio
Acoje, 1939.....	51.05	18.0	2.43:1
Zambales chromite	48.6	16.4	2.57:1
Florannie, 1935-8.	51.7	15.28	2.94:1
Dinagat	47.44	14.54	2.6:1
Cagayan area....	49.7	16.7	2.6:1
Cagayan area....	49.6	14.7	2.9:1

* "Mineral Resources of the Philippines, 1934-1938."

Table III—Analyses of Four Foreign Ores

India, Beluchistan	54.0	13.6	3.4:1
Rhodesia	54.4	14.4	3.4:1
Asia Minor	52.9	15.7	2.9:1
Russia	50.8	21.6	2.0:1

[2] U. S. Bureau of Mines "Inf. Circ. 6566."
[3] "Mineral Resources of the Philippines, 1934-1938."

Washing the chromite sands at Acoje

3,000 tons a month. With the outbreak of hostilities they increased sharply, and in 1940 leaped to 73,950 tons. Despite a scarcity of ships, it is anticipated that 1941 shipments will approximate 200,000 tons.

Nearly all the metallurgical chromite shipped to the United States in 1941 has been supplied by the Acoje company in the Zambales field. This company has grown in two years from a comparatively small producer to a position where it now ships about 15,000 to 20,000 tons a month to America. The value of the shipments given in Fig. 2 is the f.o.b. value at Zambales.

Chromite is recovered at Acoje by underground mining, where square-set stoping is employed, as well as by surface mining and by washing the alluvial chromite sands to obtain a concentrate. About one-fifth of the present output comes from underground, one-half from open cuts, and about 30 percent from washing and concentrating the sands. The last operation can be done only in the rainy months. The proportion of ore to be obtained from underground mining will steadily increase.

About 23 separate lenses of chromite have been developed by the company, from which ore is being mined. Only two have had extensive underground development. No reason appears why many of the others should not furnish worth-while tonnages below surface mining limits. Results from diamond drilling and other exploration have been sufficiently encouraging to warrant building a 1,000-ton mill for treating the large tonnage of lower-grade ores.

The new mill, scheduled to start early in 1942, will have a comparatively simple flowsheet, consisting of crushing, grinding in rod mills, and tabling. Tests have been made by well-known American firms, and the ore is said to offer no difficulties in making a high-grade concentrate. The concentration ratio, it is thought, will be about 2:1, so the company should be able to furnish a large tonnage of concentrates in addition to high-grade lump.

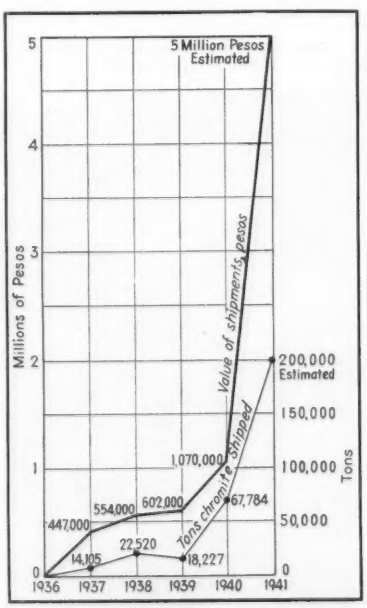
Transportation to tidewater offers a problem. The mine is at 2,000 ft. elevation, 37 km. from the dock at Santa Cruz. Of this distance 27 km. is largely one-way mountain road with frequent steep grades subject to slides from heavy rains. The ore is transported by 150 4-ton trucks. Haulage cost is about 3 pesos per ton, or 8 centavos per ton-kilometer. A large crew works on the road, which is being surfaced and widened for two-way traffic. The mine is now one of the largest employers of labor in the Islands, with a payroll of over 3,000 men.

Interest is being taken in the chromite deposits in Oriental Misamis, Mindanao. Their existence has been known for several years, but as they were not easily accessible, they were left undeveloped until demand strengthened. At present two strong companies are operating. The deposits are about 20 km. from the coast at 1,600 ft. elevation. Road building is being rapidly pushed. Already about 14,000 tons of high-grade ore has been shipped from one series of lenses. The chromite occurs in relatively small, irregular lenses, apparently limited in size and depth but recurrent along the strike. Prospecting for new orebodies is done by trenching and auger holes at close intervals in likely areas and has been fairly successful. In comparison with the ore of the Zambales field, this chromite appears to be generally of a better metallurgical grade, but the orebodies, judging by the limited development thus far, give less individual indication of tonnage. This opinion, however, may have to be revised with more development. Though much of the ore may be recovered by open cuts, it is likely that some underground work will be needed. The chromite requires no beneficiation except handsorting.

Deposits on Dinagat Island have not been worked regularly in 1941, due largely to shortage of ships. They are believed to have merit and over 7,000 tons was shipped in 1940. The grade averaged about 49 percent Cr_2O_3.

The Florannie chromite deposits, in Camarines Sur, were exhausted in 1938 and the mine was shut down. During 1935-1938 the operating company mined over 76,000 tons of ore with a Cr_2O_3 content of 51.7 percent and a Cr-Fe ratio of over 3:1.

Fig. 2 . . . Tons of chromite ore shipped by Acoje Mining Co. and the f.o.b. value of shipments at Zambales, in Philippine pesos (one peso equals 50 cents, U. S. currency)



A glance at the map will indicate how widespread are the reported occurrences of chromite in the Islands. The question naturally arises, why is the present production confined virtually to two properties? There appear to be several answers. It has been only in the last two years that real attention has been given to chromite. The price was not attractive, specifications on quality were rigid, and few engineers in the Islands had had experience either in prospecting or beneficiating the ore. Furthermore, the investing public had been taught to look upon gold mining as the chief source of mining profits, and chromite was just a name for an ore that was always confused with manganese. Even today, with priority for chromite in respect to space on freighters, the profit to local producers is not large, freight rates having more than doubled. Though specimens of good ore are frequently brought in for identification from new fields, these are rarely accompanied with engineering reports, and native prospectors have little conception of tonnages or economic factors that make a property worth development. The uncertain Japanese market, even before embargoes were put into effect, has been a further deterrent.

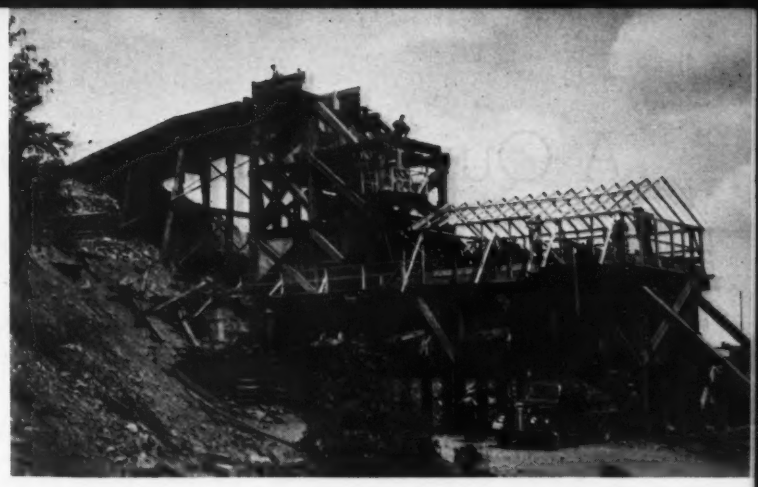
The future of Philippine chromite is uncertain. In a sense it is a "war baby" today, with a demand from the United States assured only so long as the emergency exists. Under normal conditions, it will be handicapped by a long ocean haul and relatively higher freight rates than are met by African and Turkish producers, with the added probability that the ore is somewhat inferior to the latter in quality.

On the other hand, a 500 percent increase in production in three years is no mean accomplishment and indicates that at least some of the deposits that were previously regarded with dubious eyes are capable of substantial output. Little precise knowledge is at hand regarding most of the occurrences. Much of the country is difficult of access, and even if the chromite is promising, amortization of capital investment under uncertain economic and political conditions requires that the probable profit margin shall be large.

The present emergency has placed Philippine chromite production under forced draft, so to speak, and has undoubtedly stimulated interest to a degree that would certainly not have been reached under normal conditions for years. It is likely that this interest will be permanent, and that even after the present demand has subsided, buyers will include the Islands as potential sources of supply in the future, and give tangible assistance in development of the deposits.

Champion Mine's Old Stockpiles Yield Ore in Emergency

Cleveland-Cliffs installs screening and picking plant to recover merchantable lump and fines



Screening and picking plant before roof over picking belt was finished

Separate car-loading ramps are provided at the railroad for the lump and fines respectively

MOST beneficiation plants for iron ore are on the west end of the Mesabi range, but, due to war needs and scarity of lump ore, emergency plants are being installed on other iron ranges surrounding Lake Superior. A good example is the one recently built at the Champion mine, near Champion, Mich., on the Marquette range.

This mine was first opened about 1868 and various shafts were sunk in the next 40 years until there were seven, the last one having a vertical depth of over 3,000 ft. When the Oliver Iron Mining Co. secured the property in 1904 the management operated it until 1912, when it was closed down and allowed to fill with water. At this time on the surface there were several stockpiles of mixed ore and rock, totaling approximately 150,000 tons. These piles were made up of specular and magnetic iron ore and rock, ranging in size from lumps of a maximum of 10-in. diameter down to fine dust. The mixture was too low in grade to ship without some kind of treatment, so it was left in stockpile until May, 1941, when a shortage of lump ore made it expedient for the Cleveland-Cliffs Iron Co. to take it over for treatment.

A combination screening and rock-picking plant was built of second-hand timber and idle machinery from other mines. The building, about 60 ft. long, 47 ft. high, and 15 ft. wide, is equipped with a receiving bin for crude ore, another bin for fine ore, two bins for rock, and one bin for lump ore. The bins for holding the treated ore have two gates, one on each end, so that two trucks can be loaded at the same time.

The crude-ore bin has one restricted gate to allow an even feed onto a 5x14-ft. double-deck vibrating screen that removes all the minus ¾-in. ore and passes the lump ore and rock to the two 36-in. by 24-ft. picking belts. Because most of the rock is dense and contains considerable ore, it was difficult for the pickers to distinguish the ore lumps. Treatment with high-pressure water was tried without success. It was found finally that chipping a corner from the doubtful chunks gave more information than any other scheme. On the poorest crude material, as high as seven rock pickers are needed on each belt to work the plant to capacity.

The ore is recovered from the old stockpiles with a 1-cu.yd. gas shovel that loads into 1½-cu.yd. trucks that are overloaded to 4 tons per trip. With the stockpiles so close to the plant, only one truck is needed most of the time to keep the crude-ore bin full. The vibrating screen is large enough to handle 600 tons per hour, but was used for this job requiring 125 tons per hour because it was on hand. Rock-picking slows down production in the low-grade crude-ore pile until an 8-hr. shift will not yield more than fifteen 50-ton railroad cars of fine and lump ore respectively. When the higher-grade crude ore is run through the plant, as high as forty 50-ton cars can be produced. Screening and picking rock are supervised by the company, whereas loading and hauling the crude ore as well as hauling the fine and lump ore concentrates one mile to the railroad siding is let out on contract.

Electric power is purchased from the Wisconsin-Michigan Power & Light Co., which also supplies the town. Only a small amount is needed, as the screen load does not exceed 10 hp. and the picking belts require 3 hp. each. No compressed air is used, all finger gates being operated by hand.

The plant is treating about double the capacity for which it was designed. It operates one 8-hr. shift per day and five days per week. On this basis it will require two years for the crude-ore piles to be cleaned up. C. J. Stakel is superintendent.

A Quickly Cleaned Sump

Pumps working from it, moreover, are always under a gravity head

Douglas H. Noy
Chief Engineer, Perron Gold Mines, Perron, Que.

REMOVAL OF SOLIDS from mine waters and their subsequent disposal are facilitated by use of sumps of the sort here described. Two such sumps have been in operation about two years at the Perron Gold Mines, in Quebec, and are considered satisfactory. The term "sump," as here used, refers to an excavation where mine water is collected to be pumped to surface.

Nearly all mine water contains large amounts of suspended matter, which may be both abrasive and sticky. It settles to the bottom of the sump until it builds up to a height where it is drawn into the pump intake. If this is allowed to continue for a moderate length of time, it will increase pumping costs in two ways: First, the pump impeller and casing (in the case of centrifugal pumps) will be abraded. The over-all pump efficiency will correspondingly drop, perhaps to 60 percent of the rated efficiency. Second, the sticky mattter in the mine water may build up at sharp corners in the discharge line, and the resulting decrease in pipe diameter will cause a further drop in pump efficiency.

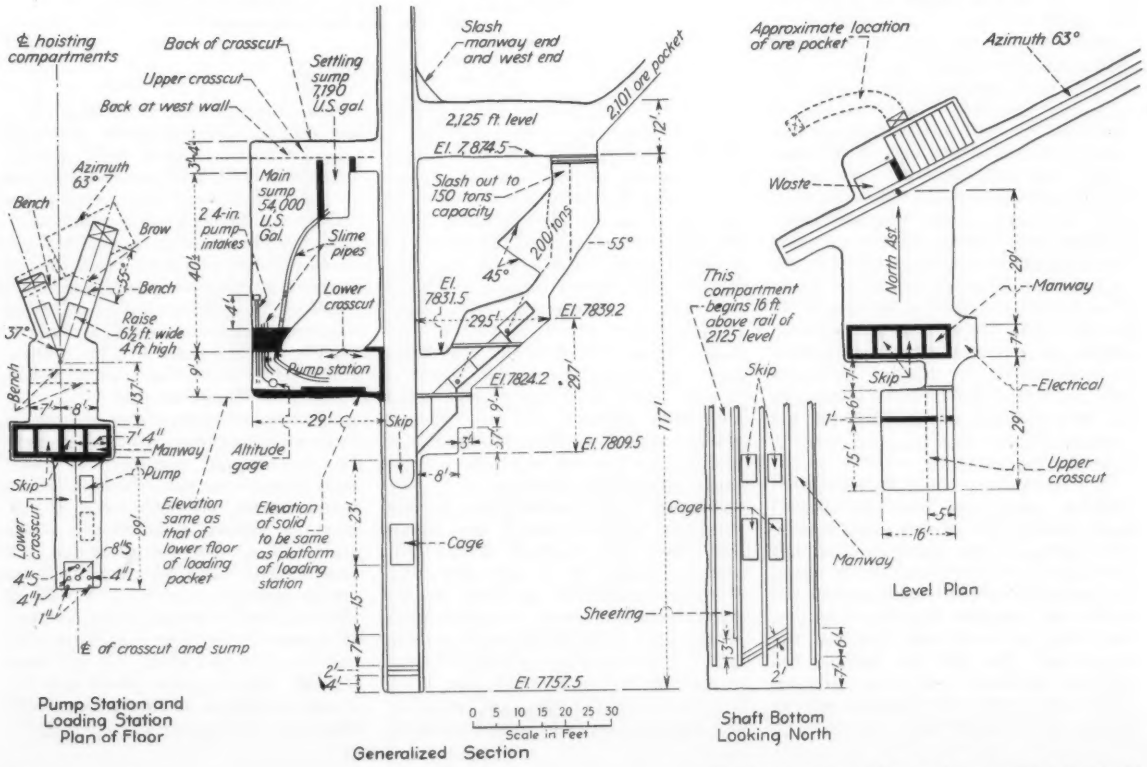
The remedy for such ills is to muck out the sump at regular intervals. This generally means only a small expense, but is a great nuisance. It is dirty work, sumps, moreover, not always being in the most accessible spots in a mine. Thus the management tends to let the task of mucking out wait a bit too long. Cleaning out the sump described is easy.

Excavation of the rock for such a sump must be done while sinking the shaft. The two crosscuts shown in the drawing are driven an equal distance from the shaft. They are connected with a vertical raise, which is then slashed out to form the sump. Intake pipes are installed, then the slime pipes. Experience has shown that a 4-in. diameter is amply large enough for slime pipes. After installation of the pipes a concrete dam is poured just above the pump station.

Disposal of settlings is accomplished by opening a valve in the slime pipe. The slime flows through a trough into the skips. The job is usually done by the cage tender and helper in five or six hours. Inasmuch as it is easily done, it may be taken for granted that it will be done frequently enough to keep dirty water out of the intakes.

This type of sump also has a desirable feature in that the pumps are fed by gravity and hence are always primed; a point worth consideration wherever automatic operation with centrifugal pumps is under contemplation.

Layout of station at No. 5 shaft on 2125-ft. level of Perron gold mine, showing use of type of sump described in text



Reducing Production Costs Through Employee Cooperation

Cultivation of mutual interest and cordial relations between company and its men can be a factor

Elmer Rowe
Butte, Mont.

IT HAS BEEN ESTIMATED that the cost of labor will usually account for at least 60 per cent of the operating expense of a mine. Much work has been done in the past to increase the efficiency of the tools and equipment the workers use, but the problem of increasing the productiveness of the workers by conscious, consistent attention to the human aspect of the problem remains largely unsolved. At least, if the solution is available it has not been utilized by industry as a whole, or the mining industry in particular, to any great extent. And any method of securing the active cooperation of the workers that promises to show a profit should not be ignored by the management of any concern.

A brief résumé of the improvements made in mining machinery in the past 25 or 30 years will indicate the tremendous advances in the productiveness of the machines used underground, and the corresponding reduction in the costs per ton of mining the ore and hoisting it to the surface. We have come a long way since the days of the "double jack" and the "slugger" machine. The haulage systems used by the progressive mining concerns today have little or nothing about them which recalls the time when mine cars were trammed by hand, or by horses or mules, and hoisted to surface, where they were dumped directly into railroad cars. There is a vast difference between a No. 2 hand shovel and a slusher or a "mucking machine." And hoisting one or two small mine cars of ore at a time is a mighty slow process compared to the size of the skips that speed through the shafts today.

When one looks at the mining machinery of today and compares it with that of a quarter of a century ago, he becomes aware of the great amount of ingenuity and engineering skill that has been utilized to make this vast improvement possible. But right on the heels of this comes the realization that these advances have all been made on the mechanical side of the industry. It appears that the engineering and executive personnel of the mining industry have been concentrating their efforts mainly on the field represented by the 40 percent of production costs and almost entirely ignoring the larger field, which is the cost of labor. It is, as one old-timer once remarked, "like laying for a gopher in the garden when there is a hawk in the hen house."

It would be pointless to speak of the possibility of reducing production costs through employee cooperation if the available knowledge on the subject happened to be scanty or in a purely theoretical stage. But although the profession of personnel administration is not so old as that of engineering, it has made rapid strides in the past decade, and a great deal of authoritative information is available and waiting to be used by anyone who appreciates its value. The importance of the human factor in industry has been recognized for some time, and an increasing number of executives are realizing that one of the major opportunities for effecting savings in the costs of production lies within this one factor.

One of the most effective of the indirect methods of cutting costs, and apparently one of the most neglected, is that of employee loyalty. By loyalty, I mean the indefinable quality that prompts an employee to do a fair day's work, and perhaps a little more, for a fair day's wages, even though there may be numerous opportunities for "soldiering" on the job—the feeling of security or well-being that comes with the knowledge, based on experience, that the shift boss as well as the rest of the executive staff have a personal interest in the employee as an individual which does not stop when he walks out of the mine yard going off shift. In short, by loyalty, I mean the desire, or the determination, to merit the respect, the confidence, and the friendship of the management when the management has demonstrated that it respects the employee, that it has confidence in him, and has displayed an attitude of friendliness in all past dealings with the employee. Obviously, management must assume the initiative. If the supervisors adopt and maintain an attitude of genuine friendliness and fair play, the employees will be quick to follow suit. The results will ofttimes be surprising, for many of the differences of opinion and petty irritations will almost automatically disappear. Much more could be said on the subject of loyalty, but for present purposes the above seems sufficient. If more is desired, it can be found in an article which I wrote for the December, 1940, issue of the *Personnel Journal.*

How does one cultivate employee cooperation? The following quotation from "The Economics of Mining," by Theodore Jesse Hoover (Stanford University Press), is very clear: "If the employee feels a sympathy with the ambitious hopes that the manager holds for the company and is given an understanding of the methods by which the goal may be achieved; if he is sure that he will get a square deal based on fair judgment of his merits and that his efforts will be rewarded by a word of appreciation as well as by more tangible advances in rank and salary—then the manager can count upon a vast reservoir of enthusiasm and cooperation that could not be purchased by any amount of money in a pay envelope." Naturally it is commendable when a manager can point to a liberal wage system, but the test of his leadership lies in the loyalty and goodwill of the employees.

As I see it, cooperation is simply the joint action of two individuals or groups, each working to supply the wants of the other. In the mining industry, management wants, and usually gets, a reasonable amount of ore at a reasonable cost. But what about the miner? Theodore Jesse Hoover asks the question, "What does the laborer

want?" Then he answers the question in this way: "Briefly, he wants a measure of security and steady employment, a fair chance for promotion and higher wages, healthful and cheerful living conditions for himself and his family, an opportunity to receive training that will advance him in his work, and, finally, some recognition on the part of the management of the importance of his place in the march of industry. These are not impossible goals, and it is the duty of the management to build up an effective organization by making every effort to insure the maximum realization of these hopes of the worker. No great efficiency can be expected from a group of dissatisfied human beings, at odds with each other and careless of the importance of their task."

There seems to be some difference of opinion regarding the advisability of acquainting the workers in the mines of the importance of their place in the march of industry, or of the essential quality of the minerals they produce. A few months ago I developed an idea for a series of illustrated posters depicting some of the odd, unusual, and dramatic uses for copper.

The purpose of the posters was to give the copper miners an added sense of the importance of the product of their labor in the lives of every man, woman, and child in the entire world. It was felt that if the miners had some idea of the many products and activities in which copper is an indispensable element they would forget some of the drudgery of their work. Perhaps they would even get a certain satisfaction out of their work because of the essential quality of the copper they helped to produce.

When the idea was presented to one of the officials of a certain mining company, it was turned down, the excuse being that it would be a costly matter. The cost of the posters did not constitute the objection, however, as they could be produced comparatively cheaply. The objection to the idea was based on the assumption that if the miners were to learn of the indispensability of copper in our civilization, they would promptly demand an increase in wages. Perhaps this belief is correct. I do not know. But if it is true, if miners think only of wages and have no interest in what happens to the copper they produce, if pride of workmanship means nothing to them, I, who am a miner, am entirely wrong in my estimation of miners. If this official is correct, the miners most assuredly merit our sincerest sympathies, for in so doing they are rejecting the things that make for a fuller, happier, more satisfying life. The poster idea was not original with me, as it has been used by a great many concerns, usually with very satisfactory results. Before going on, allow me to add that no criticism is being directed toward the official mentioned. He was simply carrying out the firm's policy in regard to such matters.

Mr. Hoover is the author of another statement which will bear repeating: "Most writers when dealing with the subject of rewards for labor performed apparently assume that there is a single reason why men work—to obtain a cash wage—and confine their discussions of labor problems to the sole topic of wages. It would appear, however, that there are a number of other motives for working, aside from a pay check, which actuate men in a greater or less degree. If this is true, it then becomes a part of the duty of the management to understand these motives and to provide for their satisfaction, if efficiency of personnel is to be increased."

Perhaps it is true that a large percentage of men work simply because they must do so in order to live, but it would be incorrect to say that all men are actuated solely by one motive—the love of money. Naturally all miners attach a great deal of importance to the figures on the pay check, but many of them realize there are other things that are only slightly less important than wages, and very frequently men have felt that the wages they receive are no substitute for the essential intangibles—courtesy, respect, cooperation, and the like.

The Successful Shift Boss

It seems evident that the shift boss who can secure the cooperation of the miners is the one who cooperates with them at all times, and who treats them simply as human beings, neither pampering them nor going to the other extreme. After all, the boss and the men are underground for the self-same purpose, and the "shifter" who cannot, or will not, make the effort necessary to secure the goodwill and cooperation of his men is placing himself under an unnecessary handicap. He can be entirely impersonal and coldly dispassionate and deprive himself, his firm and his men of that very valuable ingredient—the feeling of close personal cooperation.

On the other hand, the supervisor can issue orders, maintain discipline, and even reprimand an occasional employee without for an instant losing sight of the fact that he is simply one human being dealing with other humans. Albert Walton presents an interesting idea in his book "New Techniques for Supervisors and Foremen" (McGraw-Hill): "The supervisor who is closer to his men, directing them day by day and hour by hour under pressure of maintaining schedules, who says that he has no time for idle chitchat or a prying interest in the affairs of his workers, needs to be told that it does not take time—it saves time. A minute spent here and there irregularly, spontaneously, showing interest in the worker not as a worker but as a fellow human being, is a minute invested in better feeling, better will to work, and these are things that cannot be bought with money."

None of the essential intangibles in enlightened employer-employee relations can be bought with money. The loyalty, the cooperation, the will to work, and the intelligence of the men are given freely when the men have the assurance that management has pledged itself to give the employees its friendly cooperation, and to see that each and every man gets a square deal. Few employees want or expect more than that.

Perhaps the reader may ask, "What has all of the foregoing got to do with the matter of reducing production costs?" Briefly, it all adds up to this: There can be no genuine cooperation between employees and management without its prerequisite—loyalty. And there can be no loyalty unless the men are morally certain that they will get a square deal at all times. There can be no loyalty if the miners are not receiving a just remuneration for the work they do, or if there is no indication of genuine friendliness in all employer-employee relations.

There are a great many incidents in the course of one's employment where the worker can save money for his employer, or where he can prevent waste in a number of different ways simply by exercising a little more care or by doing just a little more work. Employees who are not loyal, or who just don't "give a whoop," are frankly not interested in such things. Moreover, they frequently are on the alert for ways of "getting by" as easily as possible, and care not the least if, in their efforts to do as little as possible and still remain on the payroll, they are guilty of sins of commission or omission which may be costly to the firm.

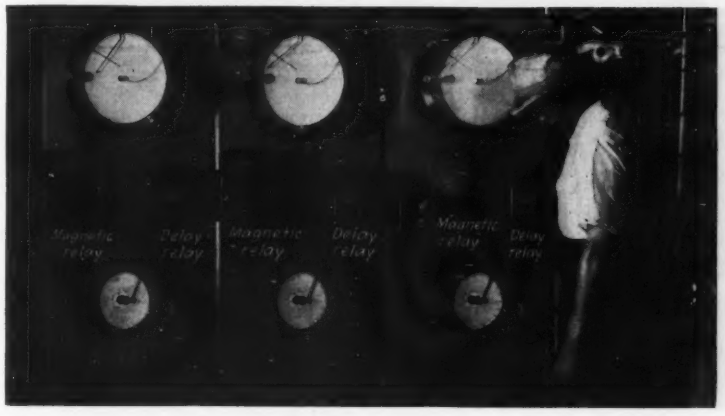
Employees who have caught the spirit of cooperation from the management can understand the viewpoint of management. More than that, it is doubtful if any but cooperative employees ever take an active part in the suggestion systems which are receiving so much attention of late. Only loyal employees are sufficiently interested in the firm's welfare to take the trouble to offer suggestions.

As the mines in this country get deeper and deeper, and costs continue to mount higher and higher, it will be found eventually that there are only two ways of cutting the cost of labor in the mines—by "driving" unwilling, uncooperative workers almost to the point of exhaustion, or by leading loyal men who have come to realize that their aims and objectives are identical with those of the management on every count. That will require a lot of time and effort, but, frankly, I am convinced that it will be worth all it will cost.

Controlling Flotation Reagents Automatically

Electrical means of feeding proportionately to ore tonnage entering mill is devised at Cuban-American Manganese plant

Frank Trotter
General Superintendent
Cuban Mining Co., Cristo, Cuba



Reagent-feeder control panel. At the top are the liquid level recorders. At the bottom are the graphic recording voltmeters, calibrated in pounds of reagent added per ton of ore milled

THE NEED for apparatus to control the feeding of flotation reagents automatically has been pronounced at the mill of the Cuban Mining Co., operating subsidiary of Cuban-American Manganese Corp. at Cristo, near Santiago, Cuba, owing to the characteristics of the ores. Here, oxidized manganese ores are concentrated by flotation to ferro-grade ore. Both mineral and gangue vary greatly in hardness. To utilize the maximum grinding capacity, continual adjustment of the amount of ore fed to the grinding circuit is necessary. Further complications are added by the contamination of the ore with a large amount of clay, which, in the rainy season, causes it to stick and hang up in the bins, causing irregularity in feeding.

This variation in feed makes it difficult to add the amount of reagents necessary for floating the manganese minerals successfully. The soap flotation employed differs from the floating of sulphide minerals in that the froth produced does not indicate by its appearance the lack or excess of reagents. To determine this the operator has to feel the froth and estimate the extent to which the mineral particles are being carried over by the bubbles. Inasmuch as the reagents are added in the grinding mill, an appreciable lapse of time takes place before the effect of any change in the amounts of reagents manifests itself in the cells.

Thus the closest attention of an operator has been necessary. Often a sharp change in tonnage has occurred before the reagents were properly adjusted, causing either loss of mineral or waste of reagents. Even with the constant supervision of an expert operator, the net result was poor mineral recoveries and high reagent costs. It was apparent that some method of adding the correct amount of flotation reagents mechanically in direct proportion to the tons milled was needed.

The method here described, accomplishing automatic regulation by means of electrical impulses, was worked out and has been in successful operation for some time. A wiring diagram of the installation is presented on the following page.

An electric relay was placed in the Rate-O-Graph circuit connected to the Merrick weightometer, which weighs the ore as it enters the mill on a belt conveyor. The Rate-O-Graph makes a graphic record of the tons of crude ore treated per hour. It is so designed that it can be placed at a distance from the weightometer and is actuated by electrical impulses caused by a small cam acting on a micro switch and momentarily closing a 110-volt a.c. circuit for each 100 lb. of ore passing the weightometer.

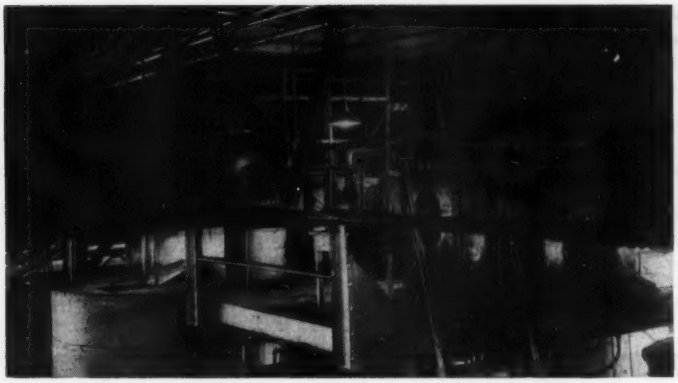
The relay was connected to the reagent-feeder motor, which thus received an electrical impulse for each 100 lb. of ore recorded. The more 100-lb. batches recorded, the more impulses per minute were delivered to the motor. Within certain limits, the amount of reagents delivered was proportional to the tonnage fed to the grinding mills.

One difficulty, however, prevents the amount of reagents from being directly proportional at different tonnage rates. The length of the interval of time during which the micro swith on the weightometer remains closed is governed by the speed of the cam closing it. When the number of 100-lb. batches per minute is large, the revolutions of the cam per minute are also large and the length of time the cam holds the micro switch closed is short.

To overcome this difficulty, a vacuum-tube time-delay relay was incorporated in the motor circuit. With it the magnetic relay closing the reagent-motor circuit is closed by the micro switch on the weightometer, and the time-delay relay holds the reagent motor circuit closed for a predetermined time, which interval can be varied by turning a small knob on the time-relay box. By lengthening

Equipment Required and Cost

G. E. magnetic switch, Type CR-7006, D-40, 7½ hp	$25
G. E. recording voltmeter, Type CR-71, volts 0-150	125
G. E. vacuum tube time-delay relay, Type CR-7504-A, 115 volts	36
Merrick weightometer microswitch attachment for Rate-O-Graph	...
Brown liquid-level recorder, Model 7721	90
Small transformer with secondary taps made in any electrical shop	5
Total	$281



Battery of reagent feeders is on the platform at right. The storage tanks are in the foreground

or shortening it, impulses of longer or shorter duration are delivered to the reagent motor; in this manner the amount of reagents added per ton of ore ground can be increased or decreased.

When more than one reagent is added, the proportion of each reagent to the others can be changed by simply turning the control knob. The knob on these time delay relays has settings for ten or more delay intervals.

If reagents are added in a dry state instead of in liquid form, an ordinary Jeffrey vibrating conveyor equipped with a feed hopper can be substituted for the motor by connecting through a controller provided with the machine.

For recording the amount of reagents, small, simple transformers operating on 110-volt a.c. current, which can be made in any electrical shop, were connected by gears to the timing knob on the delay relay and to graphic recording voltmeters having calibrated charts. Pounds of reagents per ton of ore are thus graphically recorded for each setting of the knob.

This graphic record has proved of great benefit, as can be realized. The information is particularly useful to the on-coming shift, as it saves repeating and experimenting to obtain maximum recoveries. As the system is entirely automatic, it has relieved the operator of tedious work and worry, allowing him more time for surpervising other details.

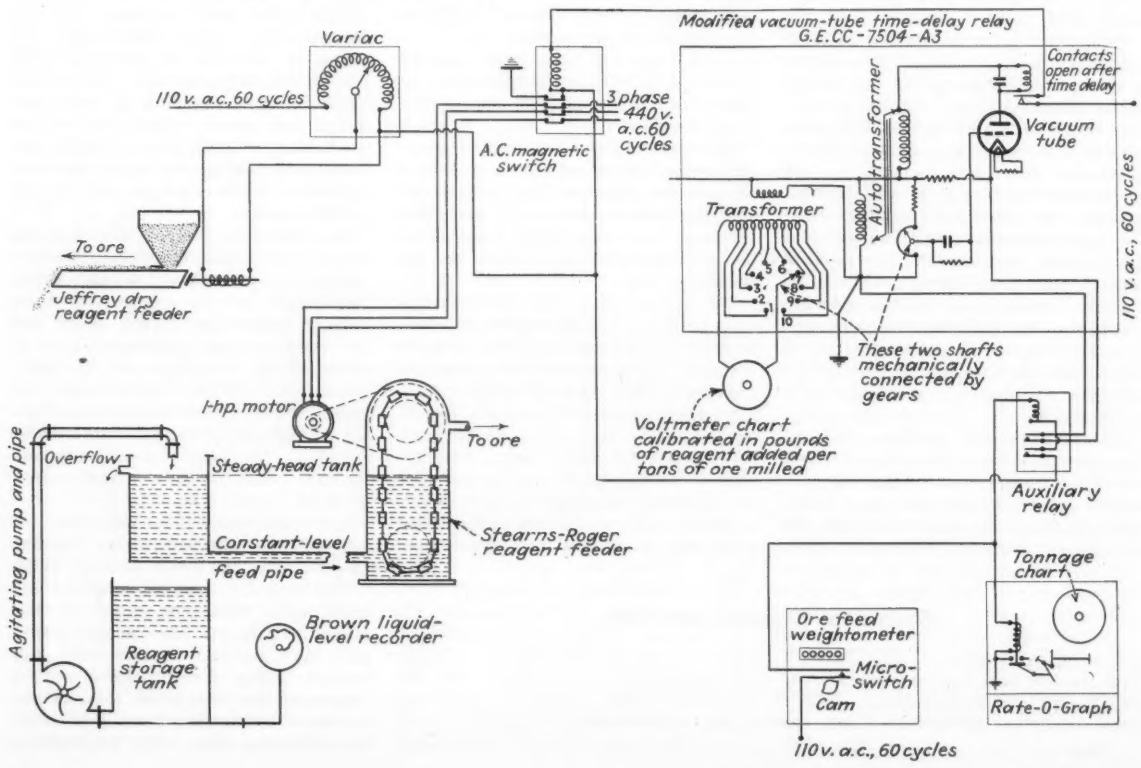
As a check the total amount of reagents used during a shift or any other set period can be determined by installing Brown liquid-level meters. With these in connection with the weightometers it is possible to check the automatic control as often as desired. With large variations of tonnage, small magnetic brakes placed on the reagent feeder motors prevent drifting of the buckets and give more accurate readings.

The lapse of time between the weighing of the ore and its arrival at the rod mills where the reagents are added should equal the time the reagents require to travel between the feeders and their points of application.

If it is desired to add the reagents to the flotation cells, a change in hookup can be made by introducing an electrical delay between the receipt of the impulse by the control mechanism and the response by the reagent feeders; or, inasmuch as the electrical controls and reagent feeders can be located in different places, it is often possible to put the feeders at a suitable distance from the point of their application to obtain the desired time delay.

Standard equipment required for this automatic reagent-control method and approximate cost of each item are given in the table on page 45.

Electrical layout for controlling rate of feed of flotation reagents at Cuban-American Manganese plant



Geology of the Powell Mine,

Pioneer Discovery in the Noranda-Rouyn Area

A striking feature is the apparent relationship between occurring basic dikes and the main vein on the property

R. C. McMurchy
Geologist
Powell Rouyn Gold Mines, Ltd.
Noranda, Que.

SITUATED two miles northwest of the adjacent towns of Noranda and Rouyn, in northwestern Quebec, the Powell mine is in a part of the province that has come into prominence during the last 15 years, due to the rapid development of mining. Today in this area, there are 41 operating gold and base-metal properties. Of these the Powell, found in 1922, was the pioneer discovery and led to a search for other ore deposits. It is operated by Powell Rouyn Gold Mines, Ltd.

During the early nineteen twenties the main gold-bearing quartz vein was subjected to intensive exploration by several companies. Work was discontinued, as the low-grade rock was not considered minable at the then existing price of gold. In 1929 copper deposits in another part of the property were explored both on surface and underground. These were soon considered unpromising, and the company again became inactive. Some years later attention was once more focussed on the original discovery, the gold-quartz vein. The price of gold having risen to its present figure, production from this source began on Sept. 1, 1937.

As to the general geology, all of the rocks with the exception of the younger diabase are believed to be early Pre-Cambrian. The volcanics are the oldest and belong to the Abitibi series—that is, they are of Keewatin type. They are intruded by medium and basic rocks and later all were intruded by granite. Following this came the acidic and basic dikes, which overlap in part; then the quartz, and finally the younger diabase, which has been classified as late Pre-Cambrian. See Fig. 1.

The dominant type in the vicinity of the vein is granite, granodiorite and hybrid phases being included with this. This mass, known as the Powell granite, is approximately 1½ miles wide and 5 miles long. It extends westward from near the east side of the Powell property, and at its western end is reported to join the 4- and 5-mile Flavrian Lake granite mass. The Powell granite has been identified as an alaskite or soda granite by Dr. M. E. Wilson.[1] On the Powell claims only small masses are free of inclusions. Most of it shows varying stages of assimilation of the older rocks and the resultant rock may be classed as a mixture of granite and volcanics which are still distinguishable as such, granitized volcanics or hybrid, quartz diorite, and granodiorite.

The volcanic rocks underlying the north part of the property are rhyolite, dacite, and andesite, the latter sometimes exhibiting amygdaloidal and ellipsoidal structure. Shearing and injection of igneous material into these has altered them in structure and composition, producing schists, breccias, and "spotted rocks" locally. The volcanics are intruded by small masses of quartz diorite, diorite, and gabbro, and later by the granite and post-granite intrusives.

In the vicinity of the vein the granite is cut by a great number of dikes of acidic composition. Near the north section many of these are quartz porphyries or porphyritic rhyolites, with numerous quartz phenocrysts in a fine-grained groundmass. Others in this section and most of those near the south section of the vein are uniformly fine-grained and are classed as rhyolite dikes. Both types of acidic dike are intruded by basic dikes locally called diabase or metadiabase, but in two exposures seen, porphyritic rhyolite dikes cut the diabase. A few small dikes intermediate in composition cut the rhyolite dikes. It is thought that all three types are closely related in age and possibly diaschistic in origin.

The diabase dikes are also abundant in the granite and many of them have been mapped near the vein. They vary greatly in width and length and likewise in strike and dip. The consistency with which one or more of them follows the main vein is one of the striking features of the underground geology. As mentioned later, they are thought to have an important relation to the vein.

The quartz veins are later than the other rocks with the probable exception of the younger diabase. Only the main vein has been studied in detail and all references are to it unless another vein is specifically mentioned.

The dike of younger diabase which crosses the property in a north-south direction is not found in the underground workings. As it dips nearly vertically, it should intersect the most easterly part of the vein at about 1,800 ft. The younger diabase has a fresh appearance, contrasting greatly with the other rocks.

Structure of the Vein—The average strike and dip of the vein are N. 35 deg. W. and 60 deg. Northeast respectively. In some parts of the mine it is as flat as 40 deg. and in others it steepens to as much as 75 deg. In much of its extent it is a single vein. Only one large fork has been discovered. On the surface there are two veins 250 ft. apart from No. 1 shaft to a point 900 ft. south of the shaft. The hanging-wall vein dips more steeply than the footwall vein and intersects it between the 200 and 350 levels. See Fig. 1.

In a stope on the 800 level four veins, each 2 to 3 ft. wide, were mined with the intervening granite. Throughout the mine the average width of quartz is about 6 ft. Below a stope recently opened at No. 3 shaft the vein in the drift averages 11 ft. for 256 ft. The vein on surface is over 4,000 ft. long. A vein outcropping approximately 1,600 ft. north of this may be part of the main vein, and, if so, would give a total length of approximately 6,000 ft. Of the 4,000 ft. more than one-third is exposed and the vein appears continuous over the entire distance. The drift on the 500 level is now 2,600 ft. long. Except for 300 ft. where the vein pinched out, it is a single continuous vein. Of this level 88 percent has either been

[1] Wilson, M. E.: "The Noranda Area, Quebec." Geol. Surv. Can., *Mem.* 266. In Press.

mined or is expected to make ore.

One or more strike faults older than or contemporaneous with the vein commonly parallel it in strike and dip. These may be on the hanging wall or footwall of the vein or may be cut through it and in some places pass into the wall rock, leaving the vein for distances as great as 75 ft. Unless playing out, these return to the vein. These strike faults are characterized by one or more of the following features: smooth surfaces, slickensides, gouge, and shearing. The slickensides vary in plunge from 5 to 55 deg. N. Some dikes older than the vein and transverse to it have been displaced by the vein fault for 40 ft. The displacement does not appear to be uniform and the greatest extent of it is not known.

Some Faults Later Than Vein

In some parts of the mine there are faults trending parallel or nearly parallel to the vein which are apparently later than it. They exhibit a small amount of gouge or displacement. Fractures with similar strike and dip occur and in some instances have narrow cavities lined with euhedral quartz or calcite crystals.

A number of faults strike transversely to the vein. One, near No. 1 shaft, displaces the north part of the vein 45 ft. to the east. This fault dies out gradually at depth and at the 1,400 level has the form of a gentle "S" fold. Two other faults of similar magnitude occur at the north end of the workings. The movement here is of the north block to the west.

Mineralization—The vein is composed of white quartz, which is barren looking except where metallic minerals are abundant. Throughout most of the mine, sulphite minerals are relatively scarce, there being less than 2 percent in most of the ore. The most abundant sulphite is pyrite, which occurs in various forms ranging from fine grains to coarse masses of cubes and pyritohedrons. Fine to medium pyrite also occurs in the wall rocks. Chalcopyrite is commonly found and is usually associated with the pyrite.

Specularite is also a common mineral in the vein and wall rocks. Some flakes are a third of an inch across. The gangue minerals chlorite and a carbonate are inconspicuous but have been determined microscopically in well-mineralized ore. Free gold has been seen on most of the levels but usually only where the vein is well or heavily mineralized with pyrite and to a lesser degree with chalcopyrite. These parts of the ore which are higher grade than the mine average are not common.

Most of the gold is fine-grained, and as the ore is low in grade it is seen in relatively little of the ore. The tellurides sylvanite and tetradymite have been reported but are apparently rare. Some specimens of high-grade ore examined by Dr. Maurice Haycock, of the Bureau of Mines, Ottawa, contain one of the tellurides—calaverite, kennerite, or sylvanite. He states that the telluride is fairly common but occurs in very small grains. He states further that there appear to be two periods of mineralization, one in which quartz, pyrite, and chalcopyrite were introduced and a second one in which pyrite, specularite, chalcopyrite, gold, a telluride, and the gangue minerals were introduced following a reopening of the vein. I am of the opinion that data observed in the field also indicate that there were two periods of mineralization.

Throughout the 4,000 ft. of vein, gold and pyrite occur even where there is no evidence of reopening of the vein. It is thought that these minerals were original constituents of the vein. The higher-grade ore and a larger quantity of metallic minerals occur near cross-faults and fractures which are later than the vein and those faults and fractures parallel or nearly parallel the vein which have reopened the vein. This mineralization is thought to have taken place after the formation of these faults and fractures, which are later than the vein.

Veins filling cross-faults and fractures are as a rule less than 1 ft. wide and in most of them there is little or no gold. They are composed of quartz and a carbonate, either calcite or ankerite. The quartz-calcite cross-veins frequently contain coarse masses of chalcopyrite and smaller amounts of pyrite. The quartz-ankerite veins are believed to be of a slightly different age than these, as they contain little or no sulphide minerals and sometimes parallel the main vein. Both types are considered to be later than nearly all of the gold, but in two of the quartz-calcite veins free gold and a telluride have been seen. The openings filled by the cross-veins probably served as channels for the solutions of the second period of mineralization of the main vein.

Entire Vein Is Mined

Nature of the Ore—The ore is low-grade, varying from the beginning of production to the present from 0.1123 oz. per ton to 0.1517 oz. per ton in any one fiscal year. As a general rule, the entire vein is mined and with it varying amounts of wall rock. Where the vein is strong it usually constitutes 50 to 90 percent of the ore. Where the vein is narrow wall rock predominates. In short sections of a few stopes there is little or no vein.

Wall rocks are granite and diabase and to a lesser extent the granite-volcanic hybrid rock. When these are of ore grade, which they frequently are, they are well mineralized with pyrite and sometimes chalcopyrite and specularite and generally show signs of silicification and carbonization. The former process seems to be more common in the granite and the latter in the diabase.

The effect of the diabase dikes on the vein and ore has not been fully worked out, but it appears that where the dike is over 4 ft. wide, the vein is narrower than average. The presence of a dike 1 or 2 ft. wide seems favorable to the vein. Apparently the fracture in which the vein lies was first occupied by the diabase dike and then reopened to allow the entry of quartz as described by Cooke, James, and Mawdsley.[2]

Dip appears to have considerable effect on the vein, the flatter parts being wider than the steeper sections. In the upper levels it is approximately 60 deg.; in the lower levels, 65 to 70. It is thought that a repetition of the flatter dip found in the upper levels may well result in a stronger vein at depth. Three diamond-drill holes below the 1,550 crosscut have intersected the vein 150, 300, and 600 ft. below the level and show its continuance in what is considered an unfavorable part of the ground.

Slips Help Stoping

As mentioned before, one or more slips older than the vein parallel it in strike and dip. These frequently mark the hanging wall or the footwall of the ore for distances of 100 ft. or more and occasionally they outline both walls. This facilitates stoping by providing a surface at which the ore breaks freely and is a guide in placing drill holes. A disadvantageous feature of them occurs when they diverge from the ore wall and pass into the country rock. Some slips die out in the wall rock, but those which return to the ore inclose between the slip and the ore a quantity of waste rock which may slough off and dilute the ore. Little trouble has been experienced from this to date. That which has occurred has been from the hanging-wall side of the stope. These slips form a guide in drifting when no vein is present. In all parts of the mine opened, the strength of these slips or faults appears approximately the same.

Economic Considerations—Two of the features of the Powell vein which made possible the development of the low-grade orebody are the suitability of the ore as flux for the Noranda smelter and its location near it. The silica content of the ore when the vein is wide and the wall rock granite is 80 to 90 percent and commands a premium. Most of the ore from the upper levels has been and is of this type. When the lower levels were opened, it became evident that the

[2] Cooke, H. C., James, W. F., and Mawdsley, J. B. (1931): "The Geology and Ore Deposits of the Rouyn Harricanaw Region, Quebec." Geol. Surv. Can., *Mem.* 166.

narrower vein and the greater amount of diabase would lower the silica content. This prompted the construction of a mill by Powell Rouyn Mines in 1940. At present approximately 500 tons of flux ore is shipped daily to the smelter and 450 tons of low-silica ore is treated at the company's mill. Shipments over the 2½-mile long road that connects the mine with the Noranda smelter have been made by truck.

Width and simplicity of structure of the ore have made possible relatively cheap methods of mining. Shrinkage stoping has been adopted throughout, with the exception of a few wide stopes in which diamond-drill stoping has been employed in part. Rock drills break about 30 tons of ore per machine-shift in the wide stopes.

Other Veins and Areas—The most notable vein on the property, with the exception of the main vein, is the "E" vein, which occurs in the east part. It is similar to the main vein, having approximately the same strike, dip, and mineralization and being accompanied over part of its length by a diabase dike. The wall rocks are granite, quartz porphyry, and hybrid. The assumed length is 1,330 ft., but a large part is covered with drift. Surface sampling of a 100-ft. section at the north end is reported to average $3.32, at $20 per ounce for gold, over a width of 13.66 ft. This vein will probably receive more attention at some future date.

The "F" vein, which outcrops between the main and "E" veins, has an exposed length of 1,000 ft. over narrow widths. Its strike is N. 63 deg. E. and the dip is steeply south. It lies in volcanics and is mineralized with chalcopyrite, pyrite, and a small amount of gold. It received some attention on account of its copper content, which has been estimated to be 7.88 percent in a part of the vein 350 ft. long, 4.1 ft. wide, and 150 ft. deep. The silver content is 3.45 oz. per ton. Other veins in the district with the same strike as this one are reported to have disappointingly low values in gold.

In the volcanics underlying the north part of the property are a number of sulphide deposits. These occur disseminated over irregular areas or concentrated in narrow shears. Exploratory work was carried out on some of these in the early days of the company's history, and a shaft was sunk to 150 ft. on one showing. No large copper deposit was found and little work has been done in recent years. The strongest sulphide mineralization occurs on the east side and close to the younger diabase dike; others occur near by to the west. In these deposits pyrite and pyrrhotite are abundant, chalcopyrite and sphalerite are less common, and galena is rare.

I wish to thank W. E. Leonard, manager, and D. S. Johnston, secretary-treasurer of the Powell-Rouyn company, through whose courtesy and cooperation this paper was made possible. Dr. M. E. Wilson, who is with the Geological Survey of Canada, very kindly consented to read the paper critically.

Part of the geology of the upper levels of the composite map is the work of various geologists and engineers previously employed by the company. Certain information regarding the "E" and "F" veins and the sulphide deposits was taken from the same source.

Fig. 1 . . . Composite geological map of part of the surface and underground workings

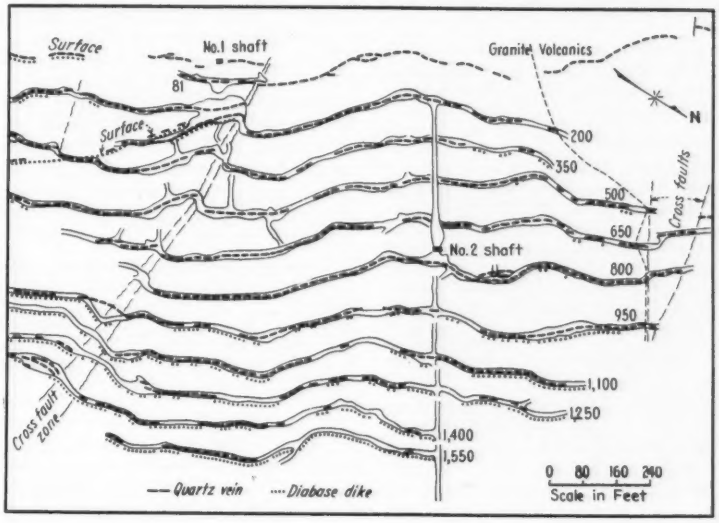
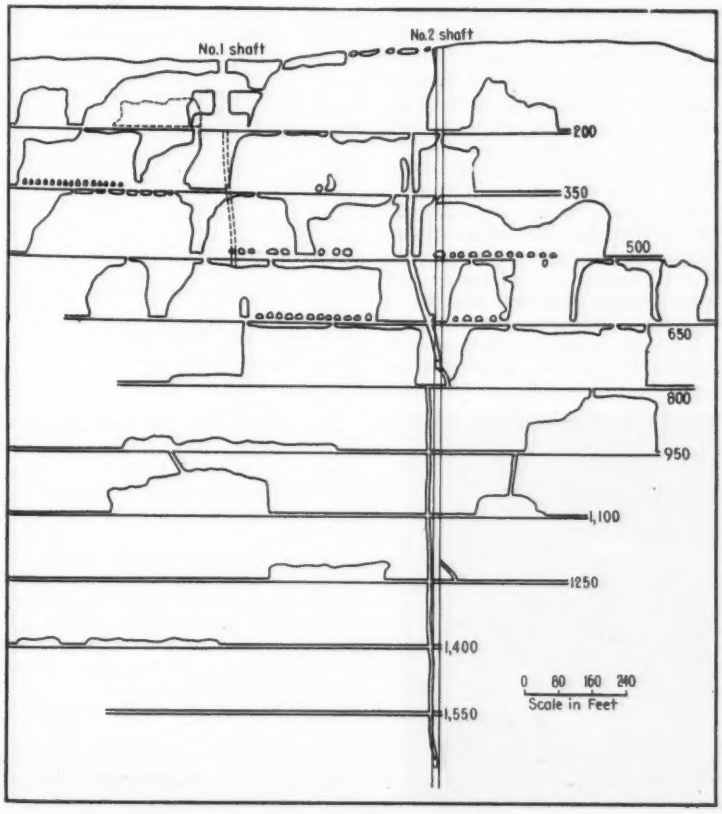


Fig. 2 . . . Longitudinal section of part of the mine looking west



Wire Rope Can Cause Injuries!

Some mining companies report on their experience

F. L. Spangler
Member, American Society of Safety Engineers, Chicago, Ill.

WHEN CONSIDERING the safe use of wire rope in mines, we cannot limit the scope of the study to factors of safety, inspection, maintenance, and replacement, for there is another aspect of wire rope use which, if neglected, is fraught with danger—namely, the injuries caused by contact with the rope. Such injuries can be divided into two classes: first, puncture wounds, lacerations, and skin burns caused by handling the rope with the hands; and second, bruises, lacerations, and other types of injuries resulting from a lashing or recoiling of an unmanageable rope that has suddenly been released while under tension.

Analysis of returns from a questionnaire mailed to a representative list of metal-mining companies reveals that injuries of these types are rather common and sometimes lead to infection and amputation of a hand or arm. A large user (not a metal mining company) says that wire rope is more dangerous than a buzz saw. Men who instinctively shy away from a saw will handle a rope with utter indifference, though the jaggers on the rope may be as disastrous as the saw teeth. Every wire-rope wound, especially a puncture wound, is a possible source of infection if not immediately treated. The workman who loses a hand through infection received from a wire rope wound is just as incapacitated as though a buzz saw had accidentally severed the hand.

Following are excerpts of reports from metal-mining companies regarding injuries received in handling wire rope:

"Infection due to negligence in removal of small pieces of wire strand or rust from same. The immediate injury is often minimized due to lack of pain at the time."

"Wire-rope hazardous? Yes. Due to the fraying out of broken wires, and the possibility of a flying end if the cable breaks. No infections have been noticed, due to the excellent first aid facilities available at this mine."

"Infections result from broken wires in strands and backlash from broken cables. We have had a number of infections from broken wires in tugger cables. Very little lost time charged to puncture wounds of this nature."

One Southern mine gives the following details of an injury case:

"Laborer engaged in freeing jaws of 'barbs' suspended from cable used as winch line on tractor raising 8-in. pipeline (oil) pricked right forefinger on end of broken wire in strand. Treated with germicide. Later became infected due to small piece remaining in finger. Result—amputation."

Another report:

"Working 1,400 men. Last year's experience shows six puncture wounds, no infection and no disability. Four persons struck by cable, three no disability and one 58 days lost. In this lost-time case, the man was astride of the cable when fellow-workman started the tugger, throwing injured man into the air, he landing on his back on coarse material."

Says the safety director of another mine:

"In 1940, out of 46 injuries due to wire and wire rope, 38 were lacerations to fingers and hands caused by broken wire ends sticking out. No time was lost and no infections were noted in any case. Injuries include cable punctures to fingers, brush burns to hands and wrists; also lacerations."

One mine reports that injuries and infections received from handling tugger ropes have been greatly reduced, with a corresponding saving in man-hours and in workmen's compensation, through use of preformed rope. The latter rope, this mine claims, seldom develops any "barbs," or jaggers, caused by ends of broken wires sticking out from the rope. When the individual wires break, the ends do not straighten and stick out, but remain in position against the body of the rope. Even heavy gloves do not always protect against dangerous barbs. Two other metal mines report that their experience has been similar and that their injury and infection rates have been reduced. At another metal mine, the tugger cable is non-preformed, but is replaced frequently, so that it never becomes worn enough to have broken wires sticking out.

Three mines report that they use guards in front of all tuggers or slushers to protect the operator from the lashing of the cable should the cable break. One mine employs a wire mesh or a bar guard for this purpose. Before such protection was provided, an accident occurred, which this mine reports as follows:

"Two men were hoisting timber with a tugger. The cable broke and both ends flew. The tugger end struck the hoistman, causing a 1¼-in. laceration over the right temple. The load end flew and struck the helper, causing a 1-in. laceration of the chin."

Another mine reports:

"We have had three cases of injuries due to backlash when the tugger cables broke. We now erect a barricade of heavy hog-wire fencing in front of the scraper hoists to guard operators from backlash in case cables should break. Barricades are also erected on the sides of the drifts if workmen must stand between the tugger and the face to watch scraping operations in the breast."

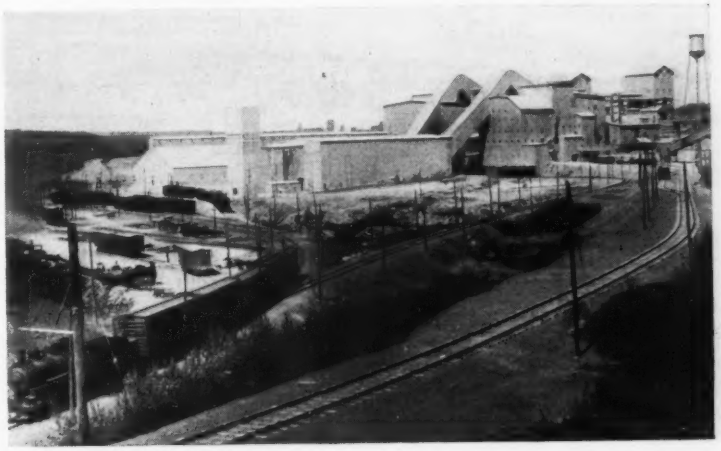
Other suggestions are offered for preventing or reducing injuries caused by contact with wire rope. To reduce the liklihood of cables breaking, causing the ends to lash about in a dangerous manner, the safety directors of two mines suggest close inspection and frequent changing of cables, so at no time is a cable in use whose strength is greatly impaired by corrosion or wear. Two mines emphasize the importance of wearing leather gloves when handling cable, and one suggests that operators be cautioned against touching cables while they are in motion.

The experiences reported by these mining companies indicate that the dangers inherent in contact with wire rope can be eliminated or greatly reduced by giving due consideration to the rope itself and to its inspection and replacement and the method of handling. Preforming apparently offers great encouragement as a means of avoiding jaggers. The need for protective gloves and prompt first aid to all injuries, however slight, should not be overlooked. In addition, training of the workman is important. The man who stands in line with or alongside of a taut rope without being protected by a suitable barricade or guard is taking appreciable risk.

Operating the World's Largest ASBESTOS MINE—III

Milling practice requires especially designed equipment to extract the many types of fibers demanded by industry today

R. A. Denovan
General Superintendent
Canadian Johns-Manville Co., Ltd.
Asbestos, Quebec, Canada



The far downcomer leaves the float chamber at the top of mill 4A in a similar manner as the one from mill 4B and both discharge light floating asbestos into the large shed that has eight chambers for collecting fibers used in making asbestos cement. The square structure at the end of the long shed houses four Cottrell precipitating units

RECOVERY of numerous grades of asbestos fiber in the two large mills of the Canadian Johns-Manville Company, Asbestos, Quebec, Canada, is a complex and involved procedure. Asbestos milling practice has required the ingenuity of many men to achieve the refinements available today, and small as the Canadian industry is, this ingenuity has not been confined to any particular asbestos-mining company. Able men have solved problems and designed equipment to produce various grades of fibers demanded by each company's respective customers.

It is generally recognized, however, that requirements of the manufacturing division of the Johns-Manville Corporation have demanded a very large diversity of asbestos fibers contained in products which have been supplied by the milling division at this company's open-pit mine. Problems of an asbestos mill man are without doubt conducive to more "headaches" than those of a mill superintendent seeking maximum recovery of metals from an ore. The common denominator of equipment for both asbestos and metal recovery plants is primary and secondary crushing units, electric power, motors, switches, elevators and conveyors, screens, and, in many cases, the use of air to separate respective products. The metal mine usually has a fixed flowsheet, determined after research on character of the ore. Separation of the various metals is aided by the respective specific gravity of each, plus the use of fine grinding; reagents, water, agitation, and air for floating fine metal particles. Resulting products are concentrates which respectively contain gold, silver, copper, lead, or zinc as the case may be. In the recovery of asbestos fiber the problem is somewhat as follows: First, the specific gravity of the rock containing fiber and the fiber itself is the same; therefore, separation cannot be won on that basis. Chemical analysis of the chrysotile asbestos mined by Canadian Johns-Manville is constant and equal to the gangue; therefore chemical approach will not help, nor will use of reagents or water aid in the fiber separation.

The fiber as stated above has neither chemical nor specific gravity differentiation from the gangue material. It can, however, be "opened"—that is, fluffed up so that it offers more resistance to air flow than granular material. Standard dry separation is basically dependent on this characteristic. Because of the change in specific volume which results from the "opening" process, the fiber can be stratified on proper screens and picked off by suction hoods, leaving the gangue material on the screens.

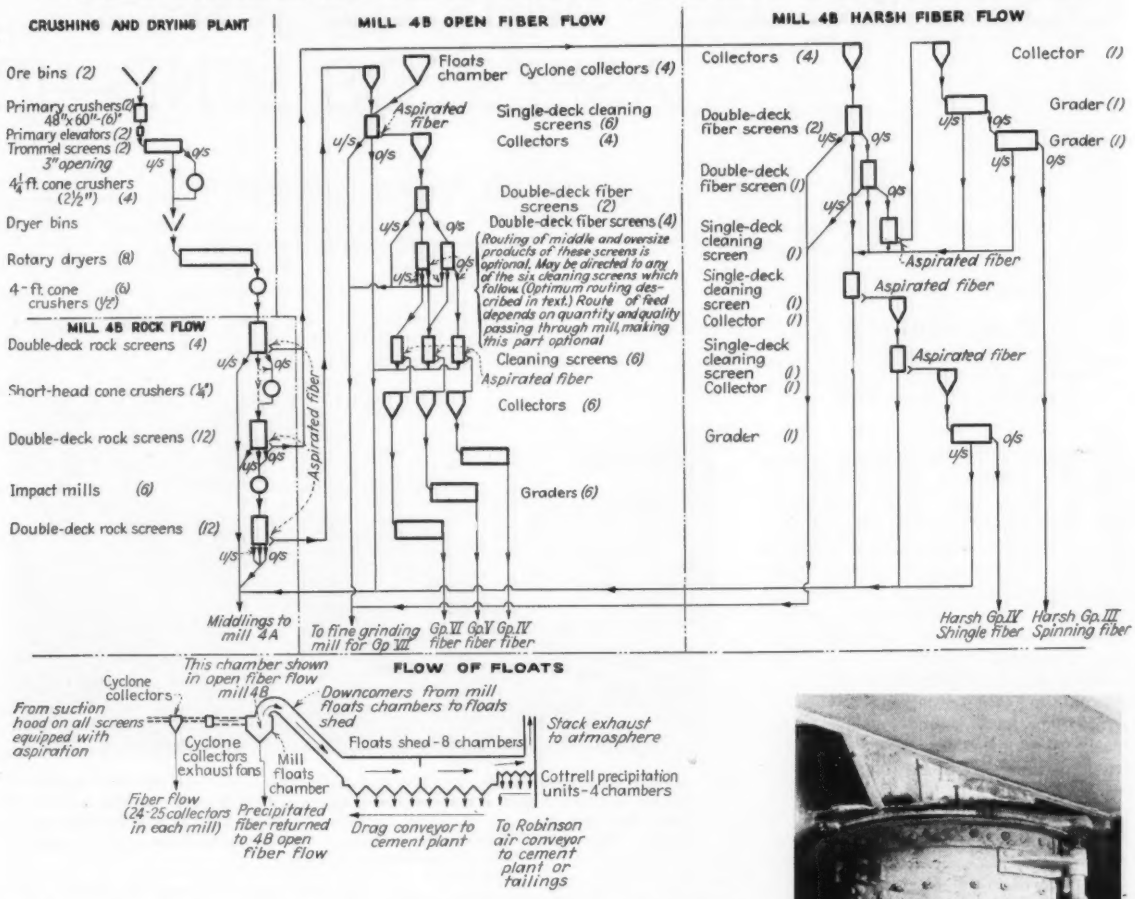
Fiber Extraction

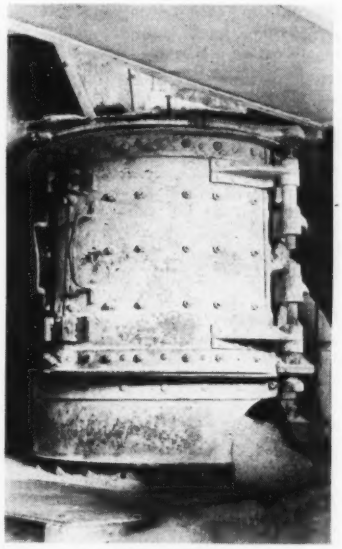
Screens are used in preference to tables because the suction needed to lift the fiber will also lift fine rock particles. The screen removes enough of this fine rock to permit a practical separation. That is, some fine rock is always lifted with the fiber, but if it can be kept within a reasonable percentage, subsequent removal by the cleaning process is feasible.

Cleaning is essentially screening and air separation. Again the air separation is based on the fluffy nature of the fiber, which causes the fiber to be carried by an air flow which will not carry granular particles, except of very small size. This fine rock can be screened out by fine-mesh screens. Well-opened fiber does not screen readily—that is, it tends to cling together. This characteristic is of value when screening out fine rock, as the screening can be done on relatively coarse screens without loss of fiber. The only real difference between the first separation of the fiber and the subsequent cleaning of the fiber is that in the first case a small percentage (seldom above 12 percent) of fiber is separated from the crushed ore. In the cleaning process a small percentage of fine granular material is removed from the fiber. In both cases, this is by screening and air separating. Preparing the ore for separation of the fiber is a simple, mechanical process consisting of drying, crushing, and sizing by screens.

Fiber extraction is basically more complex than extraction of metals. There are four nominally controllable factors in fiber extraction which are of primary importance: (a) The efficiency of extraction. (b) The length of staple. (c) The amount of "opening" of the fiber. (d) The amount

FLOWSHEET SHOWS THE IMPORTANT PRELIMINARY FEATURES OF ASBESTOS ROCK TREATMENT AND FIBER PRODUCTION


CRUSHING AND DRYING PLANT
MILL 4B OPEN FIBER FLOW
MILL 4B HARSH FIBER FLOW
Ore bins (2)
Primary crushers (2) 48"x60"-(6)
Primary elevators (2)
Trommel screens (2) 3" opening
4¼ ft. cone crushers (2½") (4)
Dryer bins
Rotary dryers (8)
4-ft. cone crushers (½") (6)
MILL 4B ROCK FLOW
Double-deck rock screens (4)
Short-head cone crushers (¼")
Double-deck rock screens (12)
Impact mills (6)
Double-deck rock screens (12)
Floats chamber
Cyclone collectors (4)
Aspirated fiber
Single-deck cleaning screens (6)
Collectors (4)
Double-deck fiber screens (2)
Double-deck fiber screens (4)
Routing of middle and oversize products of these screens is optional. May be directed to any of the six cleaning screens which follow. (Optimum routing described in text.) Route of feed depends on quantity and quality passing through mill, making this part optional
Cleaning screens (6)
Aspirated fiber
Collectors (6)
Graders (6)
Aspirated fiber
Collectors (4)
Collector (1)
Double-deck fiber screens (2)
Grader (1)
Grader (1)
Double-deck fiber screen (1)
Single-deck cleaning screen (1)
Aspirated fiber
Single-deck cleaning screen (1)
Aspirated fiber
Collector (1)
Single-deck cleaning screen (1)
Aspirated fiber
Collector (1)
Grader (1)
Middlings to mill 4A
To fine grinding mill for Gp VII
Gp VI fiber
Gp V fiber
Gp IV fiber
Harsh Gp IV Shingle fiber
Harsh Gp III Spinning fiber
FLOW OF FLOATS
Cyclone collectors
This chamber shown in open fiber flow mill 4B
Downcomers from mill floats chambers to floats shed
From suction hood on all screens equipped with aspiration
Cyclone collectors exhaust fans
Mill floats chamber
Floats shed-8 chambers
Stack exhaust to atmosphere
Cottrell precipitation units-4 chambers
Fiber flow (24-25 collectors in each mill)
Precipitated fiber returned to 4B open fiber flow
Drag conveyor to cement plant
To Robinson air conveyor to cement plant or tailings



One of the company-designed impact mills for releasing fibers from the rock. Within the shell are three sets of eight 18-lb. manganese steel hammers revolving at 1,000 r.p.m.

of granular material remaining in the fiber. All these factors have to be kept in mind during both the preparation of the ore and during the actual separation of the fiber.

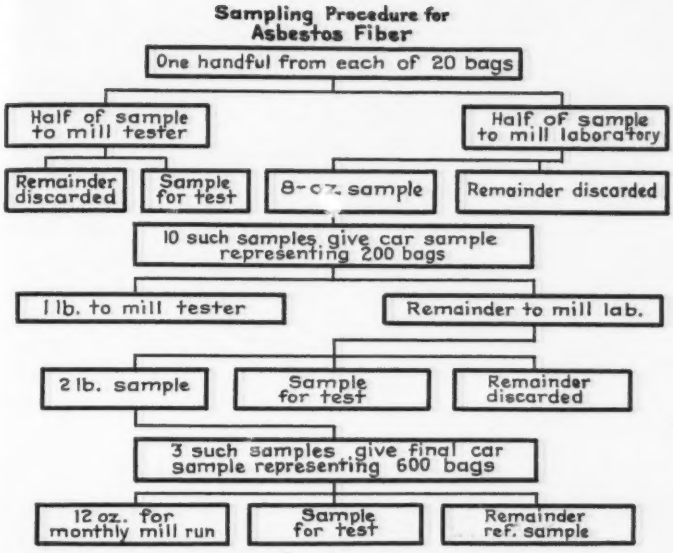
Asbestos occurs in the ore mainly in veins with the fibers crosswise of the vein. That is, the length of the fiber is the width of the vein. (There are also occurrences known as "slip fiber," where the fiber is nominally parallel with the vein.) These veins occur apparently without any fixed law. They vary from parallel sides to steep wedges and often have cleavage planes in the fiber. They vary in relative position from parallel to right angles and in width from a maximum (2 in. is considered a very rich vein) to mere hair-like lines. All these variations can occur in a single ton of ore. Normally, however, ordinary asbestos ore can, to a degree at least, be selected for the production of longer or shorter staple fiber.

Asbestos fiber is peculiar. It has no definitely determined diameter, at least within the range of the ordinary microscope. That is, to the limit of the ordinary microscope each fiber, so called, is still a bundle of finer fibers. It is this peculiarity that is indicated when a process is referred to as an "opening" process. The "opening" is really separating these bundles into finer bundles. A fiber which has not been "opened" to a marked degree is referred to as a "crudy" or "harsh" fiber.

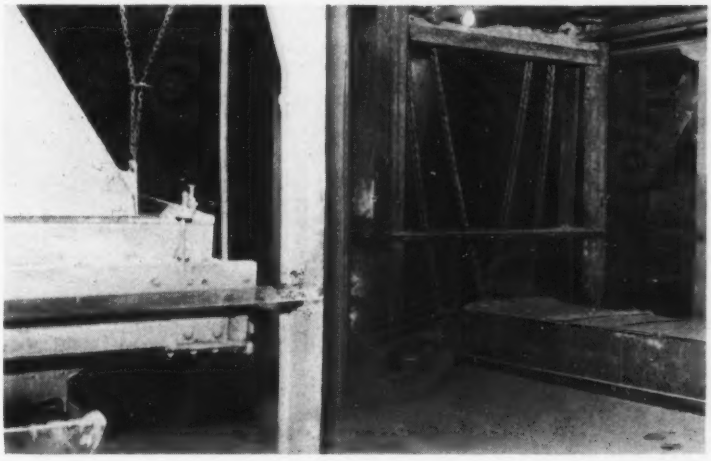
Commercial asbestos is popularly thought of as a fiber. Actually no asbestos produced by ordinary dry milling is a pure fiber but contains varying proportions of fine dust which cannot be commercially removed, as well as small amounts of fine grit. Some commercial short grades are 50 percent or more non-fibrous.

Commercial asbestos is priced by length of fiber as determined by a screen test, and the price varies with the indicated length from highest for long fiber grades to lowest for short grades. Various manufacturing processes demand "crude fiber" or "open" fiber in the long and medium grades, and varying amounts of dust or fine grit in the short grades. The asbestos miller has to be prepared to extract (a) maximum percentage of the fiber in the ore; (b) to retain a maximum proportion of the long staple for highest value; (c) control the amount of "opening" to meet customer's demand; and (d) control the dust and fine grit within practicable limits to meet customer's demand. The Canadian Johns-Manville Company produces normally about 75 different grades and has developed about 125. All of these are differentiated principally as indicated above by combinations of staple length, texture ("crudy" or "open"), and by dust or granular content.

Such an involved procedure requires considerable floor space, especially designed equipment, and an extremely


Sampling Procedure for Asbestos Fiber
One handful from each of 20 bags
Half of sample to mill tester
Half of sample to mill laboratory
Remainder discarded
Sample for test
8-oz. sample
Remainder discarded
10 such samples give car sample representing 200 bags
1 lb. to mill tester
Remainder to mill lab.
2 lb. sample
Sample for test
Remainder discarded
3 such samples give final car sample representing 600 bags
12 oz. for monthly mill run
Sample for test
Remainder ref. sample

On the left is seen part of an aspirating hood over a single-deck screen. The two gear chains in the background rotate a set of screw conveyors to transport undersize material from screen in processing Group 7 fibers



Covering of a 42-in. diameter fan that produces suction for aspiration of fibers. Capacity of fan is about 50,000 cu.ft. of air per minute

flexible flowsheet to produce these many grades of fiber. At Asbestos, Canadian Johns-Manville treats about 6,000 tons of asbestos rock per day in two mills, called 4B and 4A, both together totaling about 100,000 sq.ft. of floor space. A mill called No. 3 is not considered in the flowsheet proper, as it is used for regrading only. About 500 men are employed to operate the plants on a three-shift per day basis.

Production is usually based on monthly orders for fiber, to which a monthly milling schedule is made, specifying how many grades of fibers are to be made and when they are to be shipped. All ore from the mine passes through mill 4B, where coarse-textured grades of fiber ("crudy" fiber) are produced; thence to mill 4A, where the finer texture grades of fiber are produced. Mills 4B and 4A are essentially similar, and, as indicated, are operated in series. Materials produced in these plants which do not meet the specifications required are sent to mill 3 for regrading and production of special open or finer textured grades of fiber. Each of the two large mills (4B and 4A) has its respective equipment arranged in parallel lines, so that in case of breakage only the line affected is shut down.

Electric power for all operation is obtained from Shawinigan Falls, Quebec. Electric haulage brings rock from the mine to the crushing plant, where material is dumped into storage bins emptying onto two apron feeders 5 ft. wide, feeding two 48x60-in. jaw crushers set in 6-in. openings. All crushed rock passes into two bucket elevators. These empty into two 20x5-ft. diameter trommel screens having 3-in. openings. Oversize from the trommel screens is dropped to four 4½-ft. cone crushers, the undersize from the trommels goes via a conveyor belt to dryer feed bins. Material from the cone crushers is elevated and discharged into the same dryer bins and the combined material is fed into eight rotary dryers, revolving at about 11 r.p.m., heated by slack coal fed by stokers. From the dryers, rock is dropped to six 4-ft. cone crushers, stationed slightly below ground level of the mill and set to ½- to ⅝-in. opening. Crushed material from these units is conveyed by bucket elevators to the top of the mill, and thence into spouts feeding four rock screens.

All fibers liberated thus far and reaching these screens and retained in the oversize are removed from the screens by aspiration (removing or lifting the fibers from each respective screen by means of a powerful suction arrangement designed similar to a vacuum cleaner, which extends over the width of the screen near its discharge end). Fiber thus removed at this point is coarse-textured fiber

(commonly called "crudy" fiber). Undersize material from the above-mentioned four screens is conveyed as middlings to mill 4A for further fiber extraction. Oversize is dropped to bins feeding four short head cone crushers set to ¼ in., from which the crushed ore is again elevated to the top floor and passed onto 12 rock screens. Fibers liberated here are aspirated from these screens and join the flow of the harsh or "crudy" fibers previously removed.

All aspirated fiber thus far obtained is further cleaned and processed to meet required specifications demanded of spinning and fibers for asbestos shingle manufacture, or harsh fibers in groups 3 and 4, according to the Quebec Standard Test for asbestos fibers. Undersize from the above 12 rock screens is called sand, which goes either to tailings storage bin or to mill 4A, where numerous grades of short, open fibers are produced; the oversize passes by gravity into impact mills of company design. The outstanding characteristic of this type of mill is that it disintegrates rock by simple inertia impact, the ¼-in. rock particles while falling freely being struck by hammers revolving at a tip speed of 10,000 ft. per minute on a vertical shaft. Crushed material from the impact mills is elevated by buckets and fed to 12 double-deck rock screens. Fiber is aspirated from the top deck of these screens and rejected material is a middling, which is sent to mill 4A for further breaking by similar impact mills to produce additional grades of shorter fiber. Tailings from both mills are carried by a common belt conveyor to the tailings storage bin.

Flowsheet Is Flexible

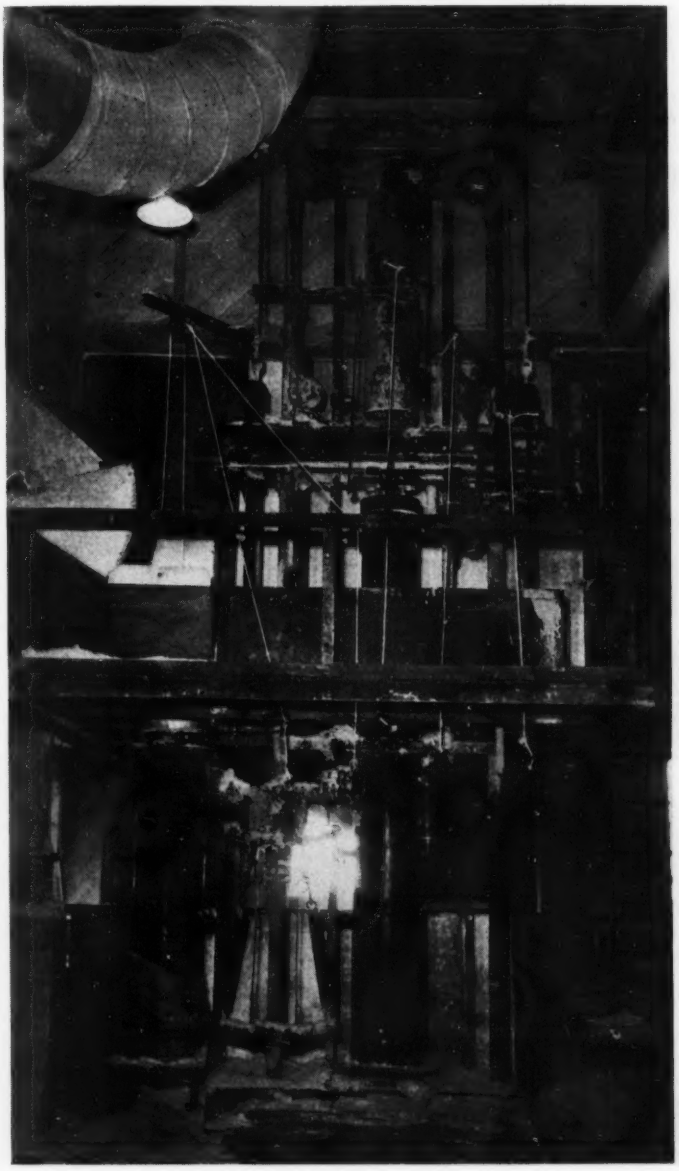
Fibers aspirated thus far (from the total 16 rock screens mentioned in the foregoing, from which harsh fiber has been aspirated) have not been greatly broken or fluffed out. All this harsh fiber collected is passed over two double-deck screens (lower deck 20 mesh) without aspiration. The minus-20-mesh fiber obtained here is used for making asbestos tiles, or for Group 7 fibers, required in other products. The middle-sized fiber from the two double-deck screens drops onto a single-deck screen, where fibers are aspirated into a single cyclone collector. Discharged material from the cyclone collector is dropped onto a cleaning screen, where loose fiber is aspirated into another single cyclone collector. Aspirated fiber from these units is dropped into a grader, the product of which is Group 4, harsh, finished fibers for use in making asbestos shingles. Rejects go to mill 4A. These harsh or "crudy" fibers constitute about 25 percent of the total fiber.

Oversize of the previously mentioned two double-deck screens is dropped onto another double-deck screen and oversize from here drops onto another single-deck screen and fiber liberated thereon is aspirated into a cyclone collector. From this collector the fiber is fed through two graders in series, the product of which is called harsh or "crudy" fiber of No. 3 group, used for spinning. The undersize of these graders is also dropped onto the first single-deck screen mentioned in the foregoing text.

Middlings from the second double-deck screen drop onto the first single-deck machine mentioned and follow through with material on this screen. Undersize from this double-deck screen is short fiber of No. 7 group. The graders mentioned are trommel type, wire-mesh screens, fitted with twin-screw conveyors and gate valves so that oversize is fed into a screw conveyor and undersize from the grader may be routed by means of valves, either to the screw carrying the oversize or to a screw conveyor returning to the mill flow. Undersize and oversize can, therefore, be combined in varying amounts by these valves, depending on the specifications of the asbestos fibers required. The screw handling the oversize fiber carries material directly to the bagging division, which is on the first floor of 4B mill.

The reader thus far may appreciate the complexity of determining any set flowsheet for asbestos, as there are so

One of six company-designed machines for bagging asbestos fibers



H. F. Janson, mill superintendent, on right, and J. L. Gartshore, assistant superintendent

J. E. Morrison, in charge of fiber inspection and control division

E. L. Moumblow, mill master mechanic

many variations involved in its treatment because the rock or ore itself has little consistent behavior in fiber content. Therefore, an asbestos milling flowsheet must be flexible. The flowsheet shown in this article is reduced to as simple terms as possible, indicating the important preliminary features of rock treatment and fiber production.

The next step is to collect "open" or fluffed-out asbestos fiber. The fiber aspirated from the 12 double-deck rock screens after the impact mills is collected into four cyclone collectors (shown at top of mill 4B open fiber flow) and dropped to six single-deck cleaning screens. Undersize of these and all subsequent screens goes to produce short No. 7 group fibers and group 8 sands. The fiber is aspirated from these six single-deck screens into four cyclone collectors, which discharge the fiber onto two double-deck fiber screens.

Oversize and middle size from these two double-deck fiber screens passes over a bank of four double-deck fiber screens, from which the oversize and middle size are dropped to a bank of six single-deck cleaning screens. The feeds to these six single-deck cleaning screens have been classified on the above-mentioned four double-deck fiber screens into three fiber groups according to staple fiber lengths. This is a preliminary step in grading operations. Liberated fibers are aspirated from these six cleaning screens into six cyclone collectors, from which fiber drops into six graders. These six cleaning screens each have their respective flow into the cyclone collector and thence into graders for mixing (by the gate valves) if necessary. Material from the six graders is classified into various fibers of groups 4, 5, and 6, controlled by specifications conforming to the Quebec Standard Test.

Each cyclone collector is exhausted through and by means of its respective fan into a large float chamber at the top center of both mills. Each of these float chambers is about 84 ft. long by 24 ft. wide by 31 ft. high and can be seen at the top of the mill in the photograph. These chambers in turn exhaust into a large 100x200-ft. float shed. As the float material or fiber is brought to this large shed by the fans mentioned it begins to settle out by its gravity or the resistance it offers to air friction, falling into eight chambers, and is then conveyed by drag chains to the cement plant, where these floats are blended into various fiber cements. Directly at the end of the float shed there is an electrical precipitation plant consisting of four units. Floats not dropping into the float shed consist of dust, which is carried by the air currents into the Cottrell plant. Precipitated material from the electrical precipitation plant is collected in four chambers and by means of screw conveyors is brought to a Robinson air conveyor, which blows the dust either into a cyclone collector for use in cements and plastic fibers or into a collector and onto a tailing conveyor to the tailing storage bin. Tailings are loaded into 30-cu.yd. Differential steel cars and hauled to the tailing dump.

Inspection and Control Division

Policing and keeping strict account that fiber production in the mill meets the specified requirements of the Quebec Standard Test for chrysotile asbestos is the major duty of the inspection and control department, headed by J. E. Morrison. The company also has a refinement in its practice involving 13 additional physical tests to meet specific requirements for asbestos products of its own manufacture and outside sales. A shipment of asbestos is subject to rejection if the tests in the mill laboratory on the final car sample do not meet the specifications. In case of rejections and return for regrading the final car sample is discarded. The procedure in mill sampling is shown on page 53. Copies of the tests on the car samples and final car sample are filed in the mill office and laboratory. Orders for fiber are usually placed in 600-bag lots of 100 lb. each. This, however, depends on the grades of fiber, as the longer fibers take fewer bags per car, because they are bulkier. Fibers of group No. 3 require about 400 or 500 bags per car; whereas, fibers in group No. 4, 5, and 6 require about 600 bags.

Rejects may be occasioned by a hole in a screen in the mill or an aspirator sucking too strong and pulling grit or rock particles into the fiber and polluting it. This department determines whether or not the fiber desired is being found in the rock and, in such instances, the milling department requests proper asbestos-bearing rock from the mine.

Dry screening by itself as prescribed in the Quebec Standard Test does not indicate, nor is it conducive to determine, the true fiber length of asbestos. Various groups of asbestos fibers have physical characteristics which make them open up or fluff easily, whereas other types do not. The more a compact fiber is agitated, the more the fiber separates itself within certain limits. Passing beyond these limits, the fiber itself will break down and be of questionable commercial use. Therefore, the physical characteristic of fiber or of its texture is determined by a test that produces a degree of openness, or fluffiness. The fibrous structure of asbestos is a physical characteristic more or less constant, but the ease with which these minute fibers or groups of fibers will pull away from one another by mechanical means can be determined only by testing. Therefore, a very complicated and complex proceeding is required to make the 75 and more types of asbestos fibers to meet the exacting requirements for making asbestos textiles, paper shingles, or pipe and many other products, from diamond-drill hole to finished product.

An advance in the technique of rapidly determining chrysotile asbestos from other types of asbestos fibers by means of a sample test employing an iodine mixture that stains the fibers has been developed by the Canadian Johns-Manville factory laboratory at Asbestos. H. S. Deeley heads the Fiber Development Department as well as the Cost Reduction Department, which analyzes costs of all operating divisions of Canadian Johns-Manville.

Making a Three-Metal Separation At the Duquesne Group

Several small mines in Southern Arizona supply Callahan Zinc-Lead's 150-ton flotation plant

150-ton flotation mill and diesel power plant operated by Callahan Zinc-Lead Co. near Duquesne, Ariz.

John B. Huttl
Assistant Editor

IN SOUTHERN ARIZONA the Callahan Zinc-Lead Co. is producing and treating a moderate tonnage of lead-zinc-copper ore near Duquesne, in the Patagonia district, in Santa Cruz County. This interesting enterprise is based on a consolidation of a group of small mines, covering 71 patented claims, which are delivering their output to a central mill near the Duquesne shaft. The outstanding feature of this mill is that it is one of the few of its size designed and operated for the separation of three metals. In other words, lead, zinc, and copper concentrates are produced. The property is known as the Duquesne group of mines, and can be reached by automobile over gravel roads either from Patagonia, the nearest railroad shipping point, or from Nogales. Distances are 20 and 21 miles respectively. Elevation is 5,500 ft.

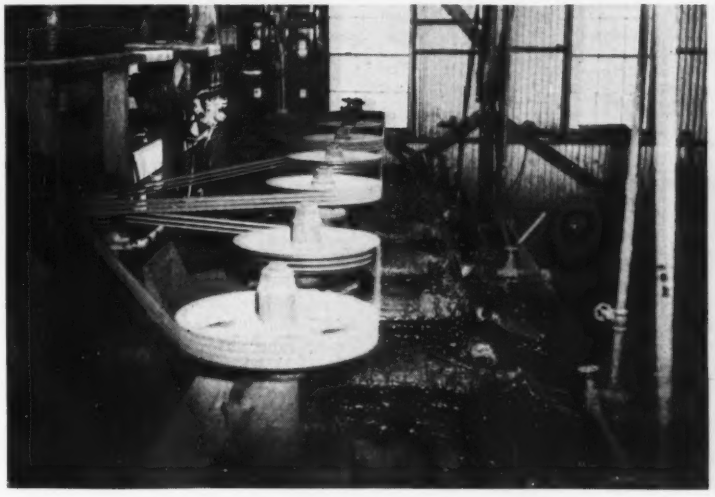
The mines are not new. The camp's early history was largely concerned with the exploitation of oxidized copper, lead, and zinc ores, and such sulphide ore from which zinc could be separated by milling and sorting. Production from 1899 to 1925 is estimated at more than $5,400,000. After 1925 the mines were worked in a desultory manner until the present operators leased them in 1939, and immediately started development, including diamond drilling. The local geology is best described by quoting excerpts from a report by Harrison Schmitt:

"The mines are situated in a block of marbleized limestone and minor hornstone about 2½ by ¾ miles, the long axis of which is north-south. This block is bounded in the north by Cretaceous rocks, apparently sedimentary and volcanic types, and their metamorphosed equivalents. The west, east, and south contacts are bounded by igneous rocks which on the whole seem to be plutonic. Most of these igneous rocks appear to be relatively young and not appreciably affected by dynamic metamorphism. Some of them, however, are strongly gneissoid and may be Pre-Cambrian in age. The pattern and variety of the 'boundary' rocks, when mapped in detail, will be much more complex than is shown by the existing maps. For example, the rock west of the so-called west contact at the Kansas mine is not quartz monzonite as shown by the Federal map, but seems to be highly metamorphosed sedimentary or volcanic rock. The rocks east of the contact include gneissoid porphyry and non-gneissoid quartz monzonite. The ore deposits are probably always either in fissure veins or along not so clearly defined lines of fracture. These are usually parallel to the schistosity of their walls, and so are high-angle bedding-plane faults. The primary ore is composed largely of the sulphides of zinc, lead, copper, and iron, with a gangue of silicates and quartz. Zinc predominates in most of the ore, which probably should be called a zinc ore with commercial amounts of lead, copper, and silver. The Washington-Duquesne camp ore deposits should be classed between contact metamorphic and hypothermal deposits."

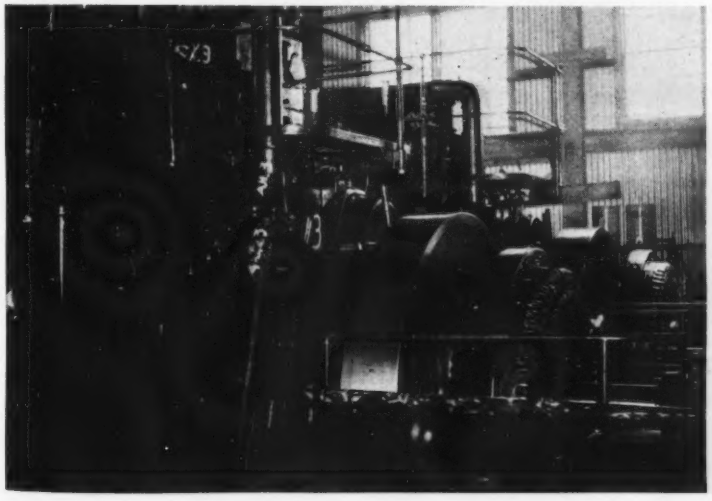
Mines actively under development and exploitation at present include the Duquesne, Holland, Estella Louise, Bonanza, and Indiana. The 650-ft. Bonanza shaft is in course of rehabilitation. This is the deepest of the group, the others varying in depth down to 200 ft. Production from the various mines is relatively small, each varying from 20 to 60 tons a day. Development work and mining methods differ according to underground conditions, as can be expected. Exploration and development are carried on by drifts, raises, and winzes, and in some instances by diamond drilling, which is done under contract. Blocked-out ore generally is mined by underhand and overhand stoping methods. Drilling is done with Ingersoll-Rand

Around the two-compartment Duquesne shaft the mill and other buildings of the camp are grouped

One of the three Denver Sub-A flotation machines in the Duquesne mill



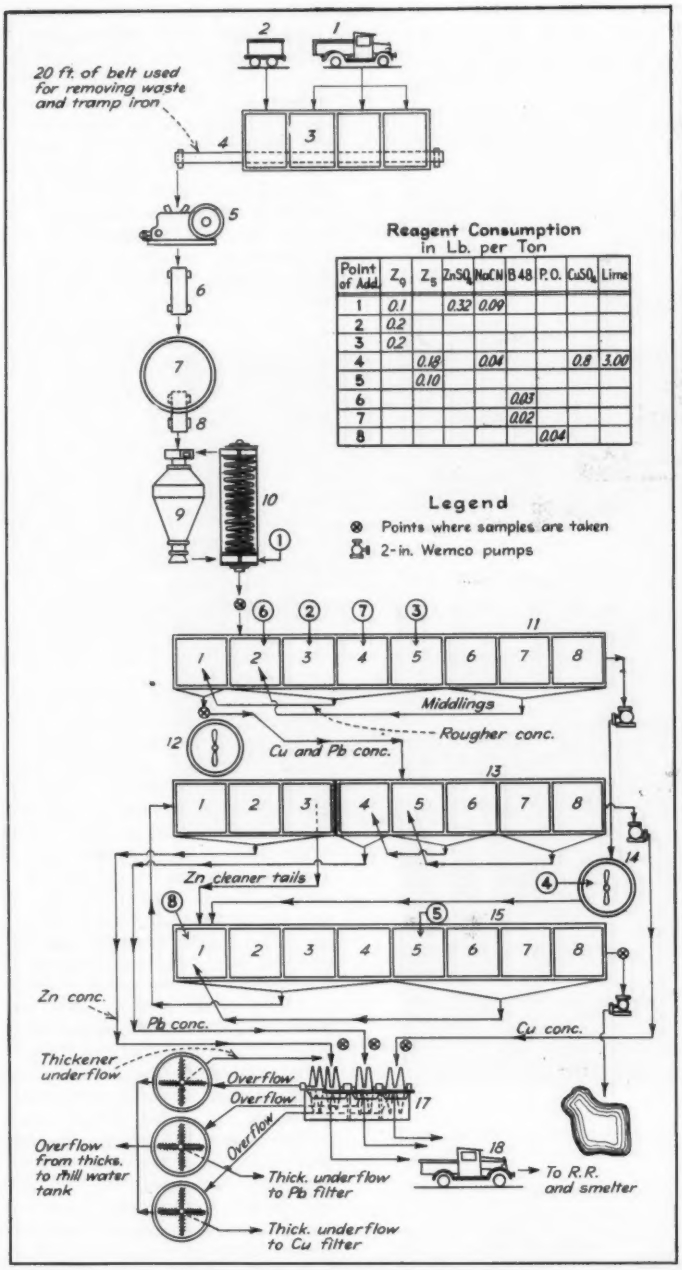
In the power house, three De la Vergne diesel engines produce power at an approximate cost of 1c. per kilowatt-hour



equipment, mostly DA30 drifters, X59 jackhammers, and R48 stopers. The 1⅛-in. hollow-round steel used with the drifters and the 1-in. quarter-octagon, hollow steel employed in the stopes are fitted with I-R detachable bits. Air for drilling is provided by three 325-cu.ft. compressors (one Gardner-Denver and two Ingersoll-Rand), and one 500-cu.ft. stationary compressor in the power house. Transportation of ore underground in some mines is done in 16-cu.ft. cars, and Joplin-type buckets, skips, and cages are used for hoisting it to the surface. The hoists employed are powered with 30- and 40-hp. gasoline engines. Save for that extracted in the Duquesne property, all ore mined is hauled to the 150-ton mill near the Duquesne shaft in 5-ton trucks. Haulage distances vary up to two miles. At the coarse-ore storage bin the ore after being weighed on a Fairbanks-Morse scale is dumped by the trucks in either one of three pockets, each capable of holding 100 tons. The fourth pocket, also of 100-ton capacity, is used exclusively for ore from the nearby Duquesne mine, the ore being dumped by 16-cu.ft. end-dump cars.

Grouped around the two-compartment Duquesne shaft are the 150-ton mill, power plant, repair shops, change house, warehouse, and office. All are wood structures covered with corrugated iron. Machinery in the mill is so arranged as to require minimum supervision. Only two men per shift are actively employed at the mill proper, though during the day shift this number is increased to five, with one man at the crusher, one sorting ore, and one at the tailings pond. The ore treated is complex, containing sphalerite, chalcopyrite, and galena with some silver. Representative values contained and recoveries made are given in Table I. The method of treatment is shown in the accompanying flowsheet.

Crushing to ¾ in. is done in a 10x20-in. Pacific jaw crusher fed by a 30-in. conveyor belt operating under the coarse-ore storage bin mentioned. Waste rock and tramp iron are removed by hand from the 20-ft. sorting section of the belt. The crusher product is then transported by an 18-in. belt conveyor to a 150-ton circular fine-ore bin at the head of the mill, whence a short belt feeder directs it to an 8-ft. by 36-in. Hardinge ball mill, with 6-in. wood blocks back of liners to make it a 7-ft. by 48-in. unit, operating in closed circuit with a 3-ft. Wemco spiral classifier. The classifier product overflowing at 35 percent solids is treated successively in three Denver Sub-A, 18-in. special, flotation machines as shown. Screen analysis of the classifier overflow is as follows: Plus 80 mesh, 11.6 percent; minus 80 plus 100 mesh, 2.2 percent; minus 100 plus 200 mesh, 24.6 per-


20 ft. of belt used for removing waste and tramp iron
Reagent Consumption in Lb. per Ton
Point of Add. | Z_0 | Z_S | $ZnSO_4$ | NaCN | B 48 | P.O. | $CuSO_4$ | Lime
1 | 0.1 | | 0.32 | 0.09 | | | | |
2 | 0.2 | | | | | | | |
3 | 0.2 | | | | | | | |
4 | | 0.18 | | 0.04 | | | 0.8 | 3.00
5 | | 0.10 | | | | | | |
6 | | | | | 0.03 | | | |
7 | | | | | 0.02 | | | |
8 | | | | | | 0.04 | | |
Legend
Points where samples are taken
2-in. Wemco pumps
Middlings
Rougher conc.
Cu and Pb conc.
Zn cleaner tails
Zn conc.
Pb conc.
Cu conc.
Thickener underflow
Overflow
Overflow from thicks. to mill water tank
Thick. underflow to Pb filter
Thick. underflow to Cu filter
To R.R. and smelter

Flowsheet of flotation plant at Duquesne group

1, Trucks from more distant mines. 2, Mine cars from Duquesne shaft. 3, Coarse-ore bins (100 tons each). 4, 30-in. feeder belt. 5, 10x20-in. Pacific jaw crusher. 6, 18-in. belt conveyor. 7, 150-ton circular fine-ore bin. 8, Belt feeder. 9, 8 ft. by 36-in. Hardinge ball mill. 10, 3-ft. Wemco spiral classifier. 11, 8-cell Denver Sub-A flotation machine (18-in. special). 12, 6x6-ft. conditioner (not in use). 13, 8-cell Denver Sub-A flotation machine (18-in. special). 14, 6x6-ft. zinc conditioner. 15, 8-cell Denver Sub-A flotation machine (18-in. special). 16, 16x10-ft. Wemco thickeners. 17, 4-ft. disk filters. 18, Truck hauling concentrated to railroad.

Mill Results for April, 1941

	Oz. Ag	% Cu	% Pb	% Zn
Heads	6.49	1.08	3.80	7.49
Tails	0.23	0.08	0.07	0.54
Cu Concentrates	12.44	27.84	5.68	7.67
Pb Concentrates	114.66	3.73	69.53	3.36
Zn Concentrates	2.24	0.94	1.09	56.38
Over-all recovery	97.20	94.26	98.50	94.23

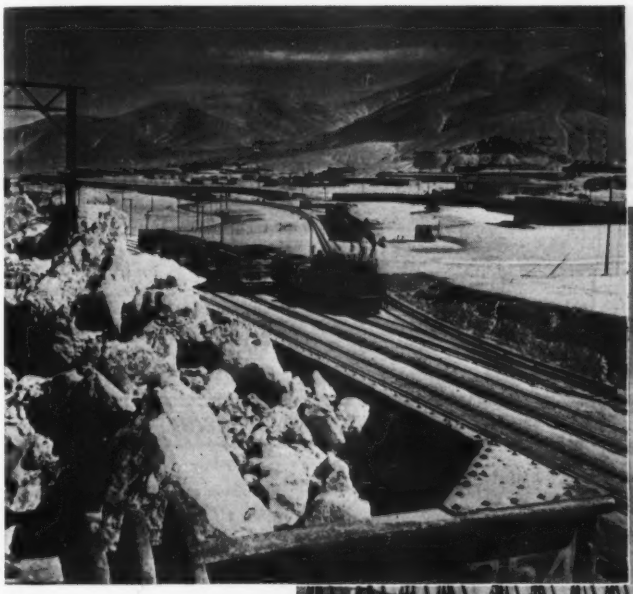
cent; and minus 200 mesh, 61.6 percent.

The copper-lead concentrate made in Cell 1 of flotation machine No. 1 goes to the second cell (Cell 5) of five of flotation machine No. 2, in which the copper-lead separation is made. Here, the lead is floated off and the copper depressed. In other words, the tailings from the copper-lead separation section constitute the copper concentrate, and the material overflowing the first cell (Cell 4), the lead concentrates. The first three cells of flotation machine No. 2 are used as zinc cleaners. Tailings leaving flotation machine No. 1 at 28 percent solids are pumped to a 6x6-ft. conditioner, from which they flow by gravity to Cell 1 of flotation machine No. 3. This cell also receives the tailings from the zinc cleaner section, as well as the overflow from cells 2, 3, and 4 of flotation machine No. 3. That from cells 5, 6, 7, and 8 of flotation machine No. 3 is returned to the head of the zinc cleaner section. Tailings from flotation machine No. 3 are pumped to the tailings pond. The different reagents used are added at points indicated in the flowsheet. Finished lead, zinc, and copper concentrates are dewatered in disk-type filters, from which the overflow goes to 16x10-ft. thickeners. The underflows from these units are returned to the filters, while the overflows go to the mill tank. This arrangement makes possible removal of the heavier mineral particles first, thus preventing overloading of the thickeners. The final concentrates are trucked to the railroad station at Patagonia, the lead and copper concentrates being shipped to the A. S. & R. smelter at El Paso, Tex., and the zinc concentrates to Amarillo, Tex.

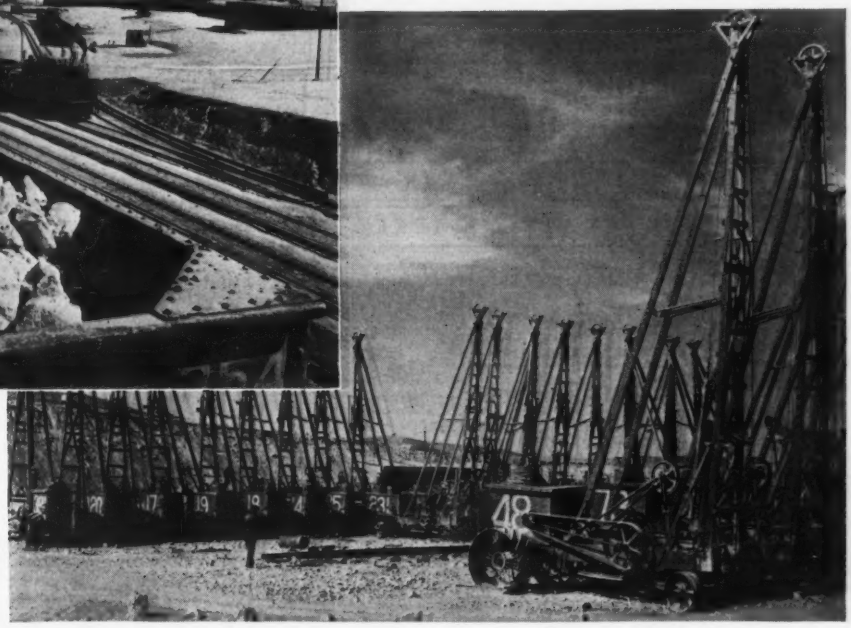
Water consumption at the mill is about 80 g.p.m., with 50 percent of it being reclaimed at the tailings pond. Make-up water is obtained from a deep well some 2½ miles from the plant. The ball mill is operated at 22 r.p.m., and the classifier at 7½ r.p.m. The ball charge is made up of 4-in. forged steel balls, and consumption per ton of ore milled averages 2 lb. All 2-in. sandpumps used in the mill are of Wemco make. Cost of electric power is around 1 cent per kw. hr., which is produced in a diesel power plant containing one 225-hp. and two 130-hp. De La Vergne engines, and a water-cooling tower. The horsepower rating given is that at sea level, from which about 18 percent should be deducted to obtain the actual engine efficiency at 5,500 ft. elevation. Waste heat is used to prepare hot water for the change house. The mill was erected under contract by the Western-Knapp Engineering Co., of San Francisco. About 100 men are employed under the direction of K. K. Hood, general manager, to whom thanks are due for permission to publish the article, and for the many courtesies shown me.

AT CHUQUICAMATA

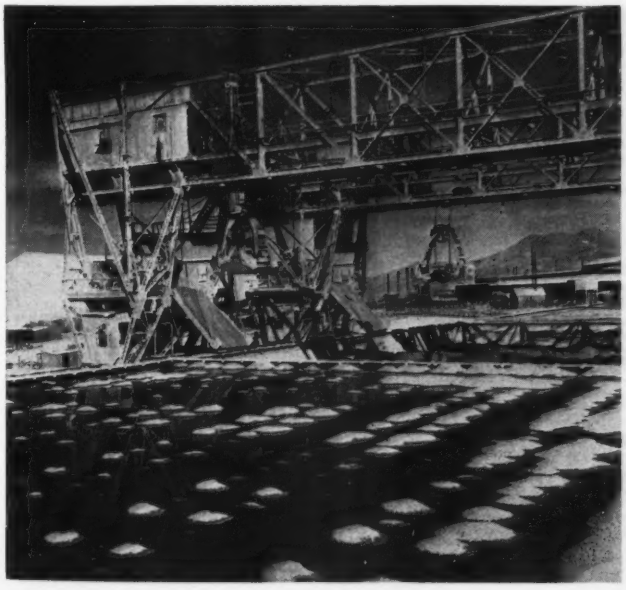
where Chile Exploration Co. is working the world's largest deposit of copper ore (see front cover)



A carload of ore in the receiving yard of the crushing plant. Just beyond is a locomotive gathering empties on the track leading to the pit. In the background is the office building and part of the staff camp

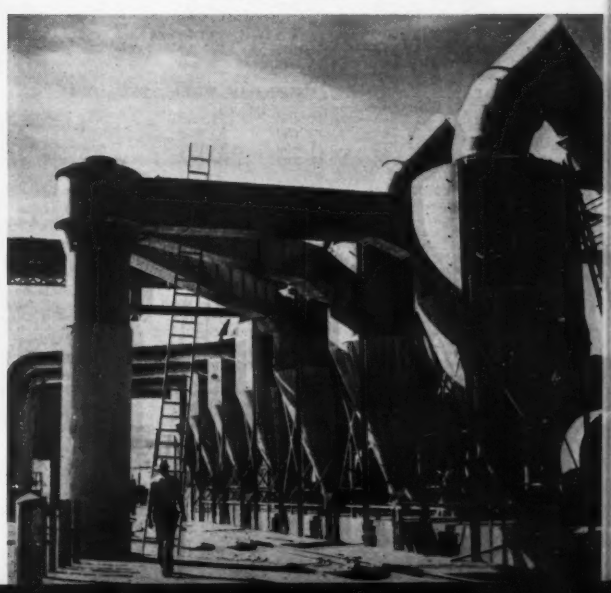


Some of the churn drills in storage at "Chuqui." The type shown is now being replaced by one of later design



Leaching vats at the plant. The one in the foreground has been covered by solution. In the next one, the unloading bridge is excavating the *ripio* or leached residue

Dust-collecting equipment at the mill



All photos by Fenno Jacobs from Three Lions

Summary of the

MARKETS

A PRICE schedule establishing a maximum of 8¼c. for Prime Western zinc became effective on Oct. 10. The uplift in the price, amounting to 1c. a pound, marked the first revision in zinc quotations since Sept. 24, 1940, and it was explained by OPA that the change was sanctioned after intensive study revealed that a higher price would definitely stimulate domestic production. The move foreshadows a higher price for lead, the trade believes. The copper situation, covering domestic operations, was unchanged. Certain high-cost Michigan producers will be taken care of through a subsidy, stimulating production through purchases by the Procurement Division of the Treasury on the basis of 1c. above the "out-of-pocket" cost.

The Government's deal to acquire Latin American copper was extended over the remainder of the year. The price agreed upon by Metals Reserve was 11¼c. a pound, f.a.s. New York. Production of Chile has been increased to the rate of about 500,000 tons a year.

Drastic controls on consumption of copper in non-essential civilian uses were imposed by the Division of Priorities, effective Oct. 21. At the same time, the order provides that consumers will be forced to cut deeply into inventories and restrict purchases to actual nearby needs. Sales of copper in the domestic market, excluding metal released by the Metals Reserve, amounted to 76,951 tons during October, against 93,719 tons in the preceding month.

Export copper in the so-called free market declined during October to the basis of 11¼c., f.a.s. With the Government releasing metal to Great Britain and other anti-Hitler countries under lend-lease, the demand for copper for export in the open market has been shrinking. In the end, the Metals Reserve is expected to buy up most of the free copper of foreign origin on about the same terms as those applying to Latin American purchases.

Metals Reserve has released foreign tungsten ore at $24 per unit of WO_3. Quicksilver advanced to $195 minimum, New York, owing to a sold-up condition of the market.

UNITED STATES MARKET

1941	Electrolytic Copper		Straits Tin	Lead		Zinc
Oct.	Domestic (a) Refinery	Export (b) Refinery	New York	New York	St. Louis	St. Louis
1	11.775	11.450	52.000	5.85	5.70	7.25
2	11.775	11.450	52.000	5.85	5.70	7.25
3	11.775	11.450	52.000	5.85	5.70	7.25
4	11.775	11.450	52.000	5.85	5.70	7.25
6	11.775	11.450	52.000	5.85	5.70	7.25
7	11.775	11.450	52.000	5.85	5.70	7.25
8	11.775	11.450	52.000	5.85	5.70	7.25
9	11.775	11.450	52.000	5.85	5.70	7.25
10	11.775	11.450	52.000	5.85	5.70	8.25
11	11.775	11.450	52.000	5.85	5.70	8.25
13	Holiday	11.450		Holiday		
14	11.775	11.450	52.000	5.85	5.70	8.25
15	11.775	11.450	52.000	5.85	5.70	8.25
16	11.775	11.450	52.000	5.85	5.70	8.25
17	11.775	11.450	52.000	5.85	5.70	8.25
18	11.775	11.450	52.000	5.85	5.70	8.25
20	11.775	11.450	52.000	5.85	5.70	8.25
21	11.775	11.450	52.000	5.85	5.70	8.25
22	11.775	11.200	52.000	5.85	5.70	8.25
23	11.775	11.200	52.000	5.85	5.70	8.25
24	11.775	11.200	52.000	5.85	5.70	8.25
25	11.775	11.200	52.000	5.85	5.70	8.25
27	11.775	11.200	52.000	5.85	5.70	8.25
28	11.775	11.200	52.000	5.85	5.70	8.25
29	11.775	11.200	52.000	5.85	5.70	8.25
30	11.775	11.200	52.000	5.85	5.70	8.25
31	11.775	11.200	52.000	5.85	5.70	8.25
	AVERAGES FOR MONTH					
Oct.	**11.775**	**11.367**	52.000	5.850	5.700	7.942
	AVERAGES FOR WEEK					
Oct.						
1	11.775	11.367	52.000	5.850	5.700	7.250
8	11.775	11.450	52.000	5.850	5.700	7.250
15	11.775	11.450	52.000	5.850	5.700	8.050
22	11.775	11.408	52.000	5.850	5.700	8.250
29	**11.775**	11.200	52.000	5.850	5.700	8.250
	CALENDAR WEEK AVERAGES					
Oct.						
4	11.775	11.450	52.000	5.850	5.700	7.250
11	11.775	11.450	52.000	5.850	5.700	7.583
18	11.775	11.450	52.000	5.850	5.700	8.250
25	11.775	11.283	52.000	5.850	5.700	8.250

SILVER, GOLD AND STERLING EXCHANGE

1941	Sterling Exchange		Silver		Gold	
Oct.	"Checks" (Nominal)	"90-day demand"	(c) New York	London	London	(d) United States
1	401.000	(f)	34.750	23.500	168s	$35.00
2	401.000	(f)	34.750	23.500	168s	35.00
3	401.000	(f)	34.750	23.500	168s	35.00
4	401.000	(f)	(e)	(e)	(e)	35.00
6	401.000	(f)	34.750	23.500	168s	35.00
7	401.000	(f)	34.750	23.500	168s	35.00
8	401.000	(f)	34.750	23.500	168s	35.00
9	401.000	(f)	34.750	23.500	168s	35.00
10	401.000	(f)	34.750	23.500	168s	35.00
11	401.000	(f)	(e)	(e)	(e)	35.00
13	Holiday	(f)	Holiday	23.500	168s	Holiday
14	401.000	(f)	34.750	23.500	168s	35.00
15	401.000	(f)	34.750	23.500	168s	35.00
16	401.000	(f)	34.750	23.500	168s	35.00
17	401.000	(f)	34.750	23.500	168s	35.00
18	401.000	(f)	(e)	(e)	(e)	35.00
20	401.000	(f)	34.750	23.500	168s	35.00
21	401.000	(f)	34.750	23.500	168s	35.00
22	401.000	(f)	34.750	23.500	168s	35.00
23	401.000	(f)	34.750	23.500	168s	35.00
24	401.000	(f)	34.750	23.500	168s	35.00
25	401.000	(f)	(e)	(e)	(e)	35.00
27	401.000	(f)	34.750	23.500	168s	35.00
28	401.000	(f)	34.750	23.500	168s	35.00
29	401.000	(f)	34.750	23.500	168s	35.00
30	401.000	(f)	34.750	23.500	168s	35.00
31	401.000	(f)	34.750	23.500	168s	35.00
	AVERAGES FOR MONTH					
Oct.	401.000	....	34.750	23.500	....	**35.00**
	AVERAGES FOR WEEK					
Oct.						
1	401.000	....	34.750	.....	....	.....
8	401.000	....	34.750	.....	....	.....
15	401.000	....	34.750	.....	....	.....
22	401.000	....	34.750	.....	....	.....
29	401.000	....	.....	.....	....	.....

Calendar week averages, New York Silver: 4th, 34.750; 11th, 34.750; 18th, 34.750; 25th, 34.750.

(e) Not quoted (Saturday). (f) No quotations.

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Owing to the European War and the disruption of normal trade relations, our export copper quotations, since September, 1939, have been based largely on f.a.s. transactions, ex United States ports. To arrive at the f.o.b. refinery quotations deduct .05c. from the f.a.s. basis for lighterage.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade Zinc delivered in the East and Middle West in nearly all instances command a premium of 1c per pound over the current market for Prime Western but not less than 1c over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

(c) Silver other than newly-mined domestic, by Handy & Harman. Under Treasury order of July 6, 1939, the price on domestic newly-mined silver mined subsequent to July 1, 1939, was fixed at 71.11c per troy ounce. Handy & Harman's quotation on newly-mined domestic silver, 999 fine was 70⅝c throughout October.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which at present is equal to $34.9125.

PRICES OF METALS • MISCELLANEOUS QUOTATIONS

LONDON MARKET

Oct., 1941	Tin Standard Spot	Tin Standard 3 months
1	256.0000	260.2500
2	256.0000	260.7500
3	256.2500	260.2500
6	256.0000	260.5000
7	256.0000	260.2500
8	256.0000	259.7500
9	256.0000	259.7500
10	256.0000	260.0000
13	256.0000	259.5000
14	256.1250	259.5000
15	256.0000	259.5000
16	255.7500	260.0000
17	255.5000	259.5000
20	255.7500	259.5000
21	256.0000	259.5000
22	255.7500	259.2500
23	255.7500	259.5000
24	256.0000	259.5000
27	255.7500	259.5000
28	255.7500	259.5000
29	255.5000	259.5000
30	255.0000	259.2500
31	255.5000	259.2500
Average for month	255.842	.....

Official tin prices on London Metal Exchange in long tons, pound sterling. Trading in copper, lead, and zinc suspended August 31, 1939.

Weekly MARKET INFORMATION Service

- E&MJ Metal & Mineral Markets, the weekly price information service of Engineering & Mining Journal, will keep you in close touch with effects of war developments on costs and availability of metals and non-metallic minerals.
- Printed and mailed every Wednesday night, E&MJ Metal & Mineral Markets will speed to you as special newspaper mail. It carries daily and weekly average prices of metals for the preceding six market days.
- Rates: $5 a year in the United States and possessions, and in the Americas; $10 a year elsewhere. Address:

E&MJ METAL & MINERAL MARKETS

Dept. 101 330 West 42nd Street New York, N. Y.

CURRENT PRICES — MISCELLANEOUS METALS, ORES, AND NON-METALLIC MINERALS

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

(Nov. 1, 1941)

MISCELLANEOUS METALS

Aluminum, ingot, 99 plus per cent, lb	15c.
Antimony, domestic, spot, lb	14.00c.
Bismuth, ton lots, lb	$1.25
Cadmium, commercial sticks, lb	90c.
Calcium, lb., ton lots 97 @ 98 per cent	$1.25
Chromium, 97 per cent grade, lb	89c.
Cobalt, 97 to 99 per cent, per lb	$1.50
Nickel, electrolytic cathodes, lb	35c.
Magnesium, 99.8 per cent, carloads, lb	27c.
Palladium, troy oz	$24.00
Platinum, (Official quotation) troy oz	$36.00
Quicksilver, flask of 76 lb., 100 flasks or more	$195.00
Radium, mg. radium content	$25.00@$30.00
Selenium, 99.5 per cent, lb	$1.75
Silicon, minimum 97 per cent, spot, lb	16.50c.
Tellurium, lb	$1.75
Thallium, 100 lb. or more, lb	$10.00
Titanium, 96 to 98 per cent, lb	$5.00

METALLIC ORES

Beryllium Ore, f.o.b. mines, ton	$30.00@$35.00
Chrome Ore, 48 @ 50% Cr_2O_3 c.i.f. Atl. ports, long ton	(b)$45.00@$47.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$4.75
Mesabi bessemer	$4.60
Old Range non-bessemer	$4.60
Mesabi, non-bessemer	$4.45
Lead (Galena) 80 per cent, Joplin, Mo., ton	$68.64
Manganese Ore, (foreign) c.i.f. U.S. ports, long ton unit of Mn:	
52 @ 55 per cent	(b) 68c.
50 @ 52 per cent	(b) 68c.
46 @ 48 per cent	(b) 63c.
Molybdenum Ore, 90%, per lb. of MoS_2, f.o.b. mines	45c.
Tungsten Ore, per unit of WO_3:	
Chinese, 65 per cent, duty paid	(b) $24.00
Domestic, 65 per cent and upward	(a)$26.00@$27.00
Vanadium Ore, per lb. of contained V_2O_5	27½c.
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton	$55.28

(a) Prices at mines, small lots, usually several dollars less. (b) Nominal.

METALLIC COMPOUNDS

Arsenious Oxide (arsenic) lb	4c.
Cobalt Oxide, 70 @ 71 per cent, lb	$1.84
Copper Sulphate, 100 lb	$5.15
Sodium Nitrate, ex vessel, in 200-lb. bags, per 100 lb	$1.43
Sodium Sulphate, bulk, ton	$18.00@$24.00

ALLOYS

Beryllium Copper, master alloy, 2.5 to 3 per cent Be, per lb. of contained Be	$15.00
Ferrochrome, 65 @ 70 per cent chromium, 4 @ 6 per cent carbon, per pound of Cr contained	13c.
Ferromanganese, 78 @ 82 per cent, gross ton	$120.00
Ferromolybdenum 55 @ 65 per cent Mo. lb. of Mo. contained	95c.
Ferrosilicon, 50 percent, gross ton	$74.50
Ferrotungsten, 75 @ 80 per cent, lb. of W contained	$1.90@$2.00
Ferrovanadium, per lb. of V, delivered	$2.70@$2.90

NON-METALLIC MINERALS

Asbestos, f.o.b. Canadian (Quebec) mines (U.S. funds), ton;	
Crude No. 1	$700@$750
Crude No. 2	$150@$350
Spinning fibers	$110@$200
Paper stock	$40@$49.50
Shorts	$13@$17.50
Vermont, f.o.b. Hyde Park:	
Shingle stock	$57.00@$60.00
Paper stock	$40.00@$48.00
Shorts	$13.00@$26.00
Floats	$18.00
Barytes, long ton:	
Georgia, crude	$8.00
Missouri, 93 per cent $BaSO_4$, less than 1 per cent iron	$6.00@$6.50
Bauxite, long ton:	
Domestic, crude, 50 @ 52 percent (not dried)	$5.00
Domestic, chemical, 55 @ 58 per cent	$7.50@$8.50
Domestic, abrasive, 80 @ 84 per cent	$16.00
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$14.50
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass-spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and	
Illinois 85–5 per cent, all rail movement, ton	$23.00
Ground, 95 @ 98 percent, bulk, ton	$32.00
Lump, acid, 98 percent, bulk, ton	$30.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton:	
Dead-burned, f.o.b. California	$25.00
Dead-burned, f.o.b. Washington	$22.00
Mica, per lb., North Carolina, No. 1 and 2 quality:	
1½ x 2 in.	45@65c.
2 x 2 in.	60@85c.
3 x 3 in.	$1.85@$2.05
3 x 4 in.	$2.15@$2.25
3 x 5 in.	$2.50@$2.75
White, ground, 70 mesh, ton	$60.00@$80.00
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a) 12c
Silica, in bags, 325 mesh, ton	$20.00@$40.00
Sulphur, Texas, mines, long ton	$16.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
New Jersey, mineral pulp	$8.50@$10.50
Vermont, extra white, 200 mesh	$9.50@$10.00
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50
200 mesh, cream colored	$26.00

(a) Nominal

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton:	
Bessemer	$24.50
Basic	$23.50
No. 2 Foundry	$24.00
Steel, base prices, Pittsburgh:	
Billets, gross ton	$34.00
Structural shapes, 100 lb	$2.10
Bars, 100 lb	$2.15

Monthly and Yearly

AVERAGE PRICES

SILVER AND STERLING EXCHANGE

	New York		London Spot		Sterling Exchange	
	1940	1941	1940	1941	1940	1941
January	34.750	34.750	21.892	23.273	395.442	(a) 402.000
February	34.750	34.750	20.935	23.341	395.652	(a) 401.864
March	34.750	34.750	20.763	23.446	375.212	(a) 401.788
April	34.750	34.750	20.713	23.500	351.817	(a) 401.058
May	34.949	34.750	21.878	23.457	326.452	(a) 400.981
June	34.825	34.750	22.688	23.400	359.560	(a) 401.000
July	34.750	34.750	22.095	23.397	379.750	(a) 401.000
August	34.750	34.750	23.261	23.459	396.889	(a) 401.000
September	34.750	34.750	23.446	23.500	401.646	(a) 401.000
October	34.750	34.750	23.451	23.500	401.692	(a) 401.000
November	34.750	.....	23.238	.....	401.783	.....
December	34.750	.....	23.015	.....	402.000	.....
Year	34.773	.....	22.281	.....	382.325	.....

New York quotations for silver other than newly-mined domestic, cents per ounce troy, 999 fine. London pence per ounce sterling silver 925 fine. Sterling exchange (pound sterling) in cents. (a) Nominal.

COPPER

	F.O.B. Refinery, Electrolytic			
	Domestic		Export	
	1940	1941	1940	1941
January	11.954	11.819	11.999	10.257
February	11.148	11.794	11.471	10.414
March	11.160	11.814	11.407	10.592
April	11.087	11.820	11.258	10.952
May	11.079	11.815	11.191	10.950
June	11.128	11.810	11.216	10.950
July	10.564	11.812	10.189	10.950
August	10.708	11.778	9.851	10.950
September	11.296	11.775	9.849	11.027
October	11.826	11.775	10.436	11.367
November	11.800	.....	10.084	.....
December	11.802	.....	10.293	.....
Year	11.296	.....	10.770	.....

New York quotations, cents per pound.

LEAD

	New York		St. Louis	
	1940	1941	1940	1941
January	5.471	5.500	5.321	5.350
February	5.076	5.602	4.926	5.452
March	5.192	5.765	5.042	5.613
April	5.071	5.850	4.921	5.700
May	5.015	5.850	4.865	5.700
June	5.000	5.850	4.850	5.700
July	5.000	5.850	4.850	5.700
August	4.854	5.850	4.704	5.700
September	4.929	5.850	4.779	5.700
October	5.308	5.850	5.158	5.700
November	5.726	.....	5.578	.....
December	5.500	.....	5.350	.....
Year	5.179	.....	5.029	.....

New York and St. Louis quotations, cents per pound.

TIN

	Straits New York		Standard, Spot London	
	1940	1941	1940	1941
January	46.707	50.154	240.716	256.648
February	45.851	51.293	242.833	264.975
March	47.079	52.067	251.711	270.131
April	46.815	51.981	252.080	269.775
May	51.570	52.166	264.098	267.534
June	54.618	52.685	273.438	262.750
July	51.591	53.481	265.592	258.272
August	51.176	52.385	262.455	257.013
September	50.348	52.000	251.024	256.364
October	51.490	52.000	257.946	255.842
November	50.577	.....	258.214	.....
December	50.101	.....	256.988	.....
Year	49.827	.....	256.425	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

ZINC

	St. Louis		
	1939	1940	1941
January	4.500	5.644	7.250
February	4.500	5.534	7.250
March	4.500	5.750	7.250
April	4.500	5.750	7.250
May	4.500	5.803	7.250
June	4.500	6.235	7.250
July	4.516	6.250	7.250
August	4.719	6.389	7.250
September	6.104	6.920	7.250
October	6.500	7.250	7.942
November	6.500	7.250	.....
December	5.980	7.250	.....
Year	5.110	6.335	.....

St. Louis quotations, Prime Western, cents per pound.

CADMIUM AND ALUMINUM

	Cadmium		Aluminum	
	1940 (a)	1941 (a)	1940	1941
January	79.038	80.000	20.000	17.000
February	80.000	82.273	20.000	17.000
March	80.000	89.038	19.769	17.000
April	80.000	90.000	19.000	17.000
May	80.000	90.000	19.000	17.000
June	80.000	90.000	19.000	17.000
July	80.000	90.000	19.000	17.000
August	80.000	90.000	18.000	17.000
September	80.000	90.000	18.000	17.000
October	80.000	90.000	18.000	15.000
November	80.000	.....	17.522	.....
December	80.000	.....	17.000	.....
Year	79.920	.....	18.691	.....

Aluminum in cents per pound, 99 plus per cent grade. Cadmium, cents per pound. (a) Producers' price, commercial sticks.

ANTIMONY, QUICKSILVER, AND PLATINUM

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1940	1941	1940	1941	1940	1941
January	14.000	14.000	156.962	165.846	40.000	36.000
February	14.000	14.000	178.000	170.182	40.000	36.000
March	14.000	14.000	180.921	177.692	40.000	36.000
April	14.000	14.000	173.538	180.077	38.923	36.000
May	14.000	14.000	181.538	180.000	38.000	36.000
June	14.000	14.000	197.360	183.920	38.000	36.000
July	14.000	14.000	194.423	188.577	38.000	36.000
August	14.000	14.000	184.111	192.000	38.000	36.000
September	14.000	14.000	173.333	192.440	36.167	36.000
October	14.000	14.000	168.846	193.615	36.000	36.000
November	14.000	.....	168.391	.....	36.000	.....
December	14.000	.....	164.960	.....	36.000	.....
Year	14.000	.....	176.865	.....	37.924	.....

(a) Antimony, cents per pound, ordinary brands, in cases; in bulk f.o.b. Laredo, Tex., 13.000 for October. (b) Quicksilver, dollars per flask of 76 lb. (c) Platinum, per ounce troy.

PIG IRON

	Bessemer		Basic		No. 2 Foundry	
	1940	1941	1940	1941	1940	1941
January	23.50	24.50	22.50	23.50	23.00	24.00
February	23.50	24.50	22.50	23.50	23.00	24.00
March	23.50	24.50	22.50	23.50	23.00	24.00
April	23.50	24.50	22.50	23.50	23.00	24.00
May	23.50	24.50	22.50	23.50	23.00	24.00
June	23.50	24.50	22.50	23.50	23.00	24.00
July	23.50	24.50	22.50	23.50	23.00	24.00
August	23.50	24.50	22.50	23.50	23.00	24.00
September	23.50	24.50	22.50	23.50	23.00	24.00
October	23.50	24.50	22.50	23.50	23.00	24.00
November	23.50	.....	22.50	.....	23.00	.....
December	23.50	.....	22.50	.....	23.00	.....
Year	23.500	.....	22.500	.....	23.000	.....

Iron, dollars per long ton. F.o.b. Mahoning and Chenango Valley furnaces.

USEFUL OPERATING IDEAS

Robert J. Owens inspecting the smoke filter units, left and right, wedged into the respective openings in the concrete bulkhead. The cable at the left has no connection with the filter

Tunnel Smoke Filter

ADAPTING THE PRINCIPLE of the gas mask on a large scale for the removal of noxious fumes from tunnel smoke after blasting, Robert J. Owens has devised an activated charcoal filter that has been successfully tested in the Carlton tunnel, Cripple Creek, Colo. Mr. Owens is industrial hygienist for the Industrial Hygiene Division of the Colorado State Board of Health. His work has been carried on in cooperation with the Golden Cycle Corp., and the tunnel superintendent, John R. Austin.

Gas in the Carlton tunnel became an acute problem when the Newmarket fault was reached, releasing a heavy flow of water and large quantities of carbon dioxide. At that time the ventilating system was reversed and outside air was blown through the 18-in. vent tube to the face of the tunnel. This insured good air at the heading, but it also meant that, after blasting, large volumes of powder smoke would drift slowly toward the portal, forming smoke plugs throughout the length of the tunnel. It was highly desirable to devise some means of removing these noxious gases.

At this point the idea was conceived of exhausting the powder gases from the face into a bulkheaded airtight rock chamber from which they could escape only through activated charcoal filters sealed into the bulkhead. Reference to a plan of the Carlton tunnel, published in *E.&M.J.*, Sept., 1941, on page 50, will show why it was found convenient in this case to use a 200-ft. dead end of the original tunnel as the airtight rock chamber. The open end was bulkheaded with a 4-in. wall of quick setting concrete, and two filter frames, 2x4 ft., and 3x4 ft., were wedged tightly into place. The illustration shows both frames and the exhaust tube entering the chamber. Each frame holds a number of filter sections containing activated charcoal. Both sides of the frames are covered with a fine-mesh screen. Various combinations of chemicals and filters were tried before the unit was in satisfactory operation. The efficiency of the system finally adopted is shown by reduction of carbon monoxide in the air from 0.15 percent after blasting to 0.01 percent on issuing from the filter.

▼

Arc Welding Cuts Costs

DEFENSE DEMANDS have placed such heavy burdens on mining equipment manufacturers that many mining companies are using arc welding for construction of special mining machinery. Listed below are three typical jobs of specialized construction performed by E. W. Koppe, of Kingman, Ariz., for gold mines in that vicinity.

1. Pump column constructed from pipe and flat steel cut with acetylene torch and then fabricated with electric arc welder. Inner tubes welded to collars so that they may be taken apart. Construction in 6-ft. sections.

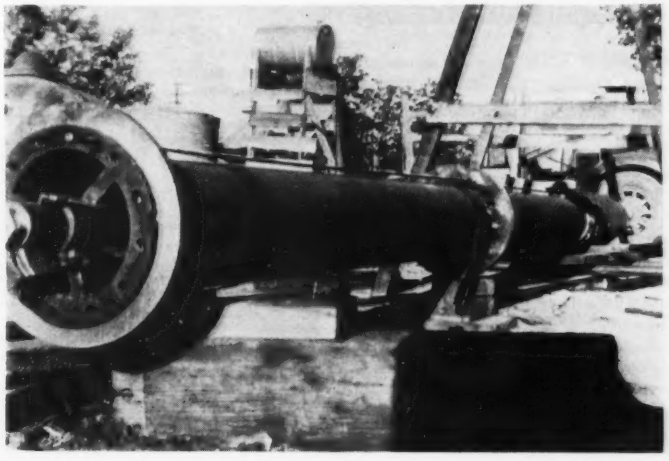
Cost of Construction by Arc Welding

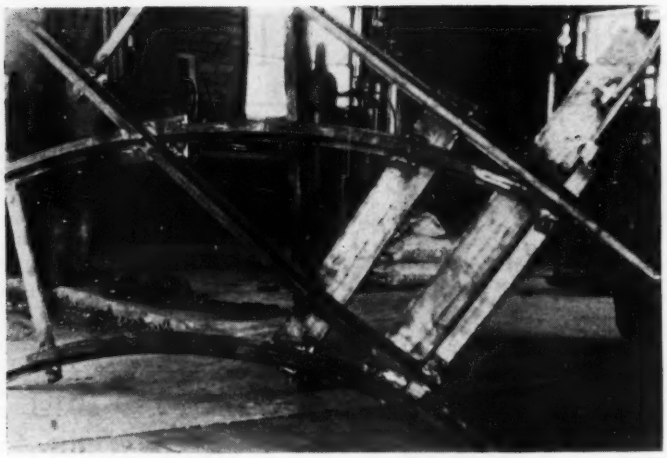
20 ft. 10-in. pipe	$36.20
20 ft. 2½-in. pipe	5.00
20 ft. 1½-in. pipe	16.00
38 lb. bronze for bearings	21.50
Labor cost of set up, 32 hours	32.00
Labor cost of welding, 12 hours	12.00
Labor cost of facing on lathe	18.00
Electrodes, 7 lb. @ 9½¢	0.66
Power cost	0.50
Total	$141.86

Previous cost $195.00 (new). Savings from arc welded construction $53.14.

2. Dragline scraper. Constructed from ½-in. steel plate and bars. All arc-welded construction. Costs on p. 64.

Pump column constructed from pipe and flat steel





Small switch made by bending rails and welding

Cost of Construction by Arc Welding

9 sq.ft. of ½-in. steel plate. 362 in. @ 5¢	$18.10
12 ft. of 1x4-in. bars and 1x2¼-in. bars	12.25
Labor cost of cutting and set up, 3 hours	3.00
Labor cost of welding, 6 hours	6.00
Electrodes, 13 lb. @ 9½¢	1.24
Total	$40.59

Previous cost $75.00 (new). Savings from arc welded construction $34.41.

3. Small switch. Constructed by bending rails to shape after heating on blacksmith's forge and then joining by arc welding.

Cost of Construction by Arc Welding

21 ft. of 12-lb. rail, 84 lb. @ 5¢	$4.20
21 lb. iron ties @ 5¢	1.05
Labor cost of bending, 3 hours	3.00
Labor cost of welding, 2½ hours	2.50
Electrodes, 1½ lb. @ 9½¢	.14
Total	$10.89

Previous cost $27.50 (new.). Savings from arc welded construction $16.61.

In these three simple construction jobs alone arc-welded construction by a local job shop saved the mining companies $104.16. Most of the work was performed for the United State Bureau of Mines in Yucca, Ariz.

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Heating Cyanide Solutions

WHEN THE MILL of Standard Cyaniding Co. was erected in 1939 near Lovelock, Nev., winter problems required attention, since records showed temperatures reaching 30 deg. F below zero in recent years, writes D. Ross Fraser, secretary-treasurer. The mill is designed to cyanide 500 tons of low-grade gold ore a day, separating sands and slimes, leaching the sands, and thickening, agitating, and washing the slimes. Equipment is housed in a large building covered with galvanized, corrugated steel, with more than 30,000 sq.ft. roof area, and wall areas aggregating 21,000 sq.ft.

After much study, it was decided to heat the solutions sufficiently to prevent their freezing under extreme winter conditions rather than heat the mill building proper. The equipment layout decided upon included an oil-fired hot-water boiler, a series of coils immersed in the solutions, and a pump to circulate hot water. As the number of coils required for immersion in solution storage tanks would be too great, it was decided to install the coils in a launder delivering solutions to the lower part of the mill building, as explained in the sketch. To assure high efficiency, arrangement was for counter-thermal flow.

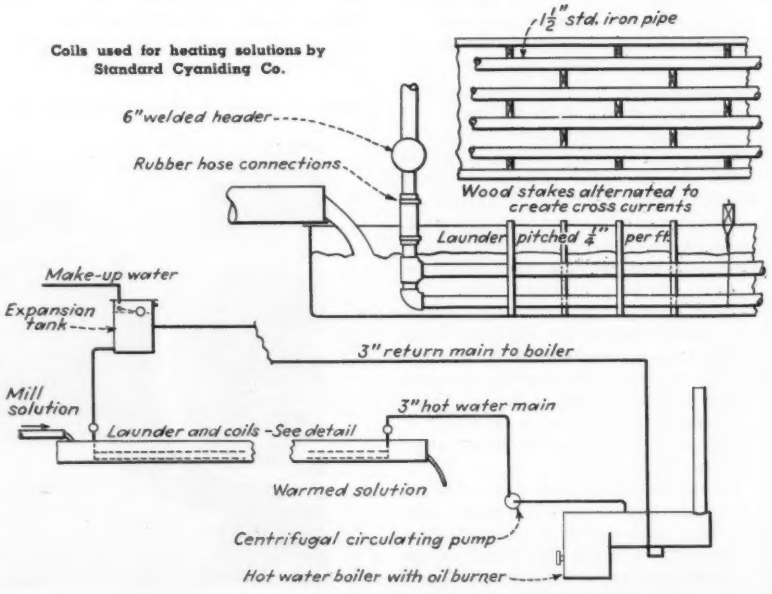
Data for the installation were obtained from similar heat transfers designed by Mr. Fraser, and used for cooling jacket water of diesel engines of the Caliente Cyaniding Co. at Delamar, Nev. Three sets of different dimensions had been used with varying rates of flow of hot water and cooling solutions. In general, the greatest capacities for heat transfer were obtained with high velocity through the coils, and the best possible agitation of the cooling solutions over the coils. Efficiency of the coils also depended on keeping them free from scale and slime deposits. Available data showed 840 B.t.u. per hour transferred per degree of difference between entering hot water and cold solution with a velocity of 160 f.p.m. of water through the tubes, ranging to 300 B.t.u. per hour with a velocity of 56 f.p.m. of water through the tubes. The tubes were 1-in. (outside diameter) seamless steel pipes, 14-gage, slightly coated with scale, length being about 450 times the diameter, and the volume of cooling water five times the amount of hot water passing.

Based on these data, eight lengths of 1¼-in. standard steel pipe, each about 87 ft. long, were installed in a steel launder 20½ in. wide and 15 in. deep as indicated. The coils are above the bottom of the launder so as to avoid possible accumulations of mud or slime, and staggered stakes between the coils which act as baffles cause thorough cross agitation of the solution flowing in the launder. Sufficient stakes are used to hold back the flow and keep the pipes covered. The launder is on a grade of ¼ in. per foot, and handles 2,000 tons per 24 hr.

Five Dollars for an "Idea"

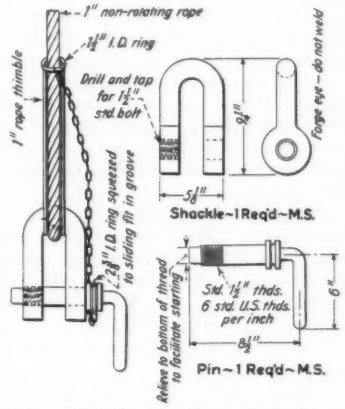
SEND your contribution. *E.&M.J.* pays a five dollar minimum for all operating ideas accepted for publication. Just sketch it, or photograph it, and describe it in sufficient detail to give the complete idea, then send it in. Our readers want it.

Coils used for heating solutions by Standard Cyaniding Co.



Shackle for Sinking Bucket

THE accompanying description and drawing of a shackle is submitted by C. G. Kemsley, mechanical superintendent, Dome Mines, Ltd., where the device is used to attach the sinking bucket to the cable. It is popular with many operators because it gives the utmost protection to the men working in the shaft. If the bucket should accidently get caught in the shaft while being hoisted, there is no danger of the shackle bending and opening, thereby releasing the bucket, as would be the case with an open hook with a spring or other means of closure. If the end of the pin is turned down as shown in the illustration, the thread is readily engaged and buckets can be changed without loss of time.


1" non-rotating rope
1½" I.D. ring
1" rope thimble
Drill and tap for ½" std. bolt
Forge eye – do not weld
9¼"
5⅛"
Shackle–1 Req'd–M.S.
2⅜" I.D. ring squeezed to sliding fit in groove
Std. 1½" thds. 6 std. U.S. thds. per inch
6"
8½"
Relieve to bottom of thread to facilitate starting
Pin–1 Req'd–M.S.

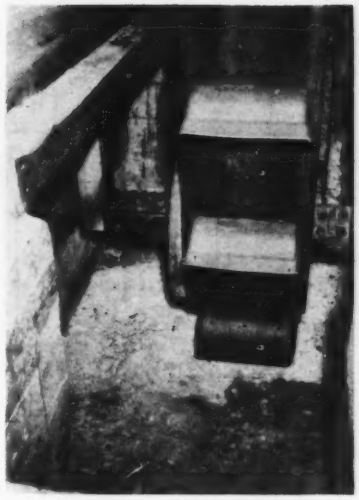
Sinking Shackle for 50-Cu. Ft. Bucket

▼

Improving a Bucket Elevator

USE OF STUB SHAFTS in the boot of a vertical V-bucket belt elevator handling wet fluorspar ore in the mill of the Victory Fluorspar Mining Co., Elizabethtown, Ill., reduced both labor and material cost of shaft renewals. On this same elevator, trouble by reason of the wet fine material sticking in the buckets was eliminated by drilling three small holes in the bottom of each bucket.

This elevator has, in the boot, the non-lubricated wooden bearings on the ends of 4x6-in. take-up timbers as is typical of the design of most elevators in that type of duty at fluorspar mills of southern Illinois and western Kentucky. Wet abrasive material getting into the bearings causes considerable shaft wear. In this Victory mill, built in 1935, the 2 7/16-in. solid shaft of the bottom pulley projects but 5 in. beyond the hub on each side. Renewable journal pieces, each 10 in. long, are fastened to the solid shaft by bolted couplings.



Stub shafts are held by bolted couplings

To provide a convenient and accurate means of adjusting the 4x6-in. take-up timbers, turnbuckle rods have been applied to the levers which hold the timbers down. Close adjustment is required because of the flat-faced pulley which must be used with this type of belt-bucket elevator instead of a crown pulley.

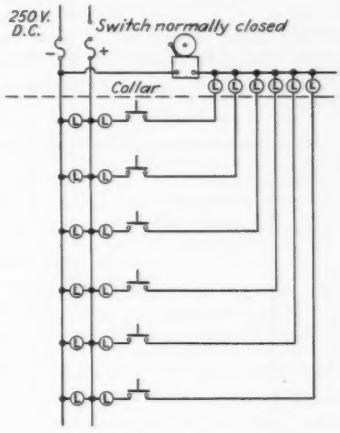
The reason for refusal of the fine material to unload from the buckets was "figured out" after practical experiments had failed to hit on a solution. The puzzling part was that the material really did not seem to stick to the metal. It was reasoned that a partial vacuum formed in the bucket. When small holes were drilled in the bottom of one bucket to serve as air intakes that bucket discharged immediately as it rounded the head pulley. After experiments were completed to determine the number and size of holes necessary, three holes 7/16 in. in diameter were drilled in the bottom of each bucket.

Turnbuckle rods pull on the side levers to hold down and adjust the 4x6-in. bearing timbers

Hoist Current for Signal Service

IN MANY mine-hoist installations one voltage suffices for all purposes. Thus the electrician must devise ways and means to obtain other voltages when needed. Obviously he cannot use transformers to step down the potential and therefore must insert resistances in the auxiliary circuits by coupling bells and lamps in series for desired results. Even though a hoist installation may be of a temporary nature, it is good planning to provide a signal system that gives both visual and audible two-way signals.

All too many accidents have occurred in hoisting service through misunderstood signals or by unintentional signals that were caused from crossed connections or grounds. The ability of the miner to see the signal he sends the engineer is a distinct advantage, and it is the function of the engineer to repeat the signal back to the sender or to indicate its receipt through a prearranged code.



The accompanying diagram illustrates the circuit that functioned with excellent results in a winze-sinking operation and later in a utility shaft that served a large group of miners engaged in development work, states P. C. Ziemke, of Milwaukee, Wis. Each pushbutton station is in series with two lamps, as is the hoist room vibrating or single-stroke bell. Thus the signaller is fully aware of the correctness of his signals, but should he sound an unintelligible signal, the engineer can immediately inform him of the fact by using the flasher system.

Another worth-while advantage of this system is the ability of the engineer to distinguish the station from which the signal originated, thereby eliminating the dangerous practice of permitting men to ring the cage up or down from a station other than the

one at which the cage is located. Where the engineer is required to repeat all signals, the flasher lamp at each station indicates the movement of the cage, so that persons within sight of the flasher are informed of its movements.

All the lamps used in the flasher circuit, and in parallel across the line, are 250-v. 16-cp. carbon lamps and the series lamps are 115-v. of the proper resistance or watt value to match the best performance of the bell. Mill-type bulbs are best suited to withstand severe vibrations set up by mining operations.

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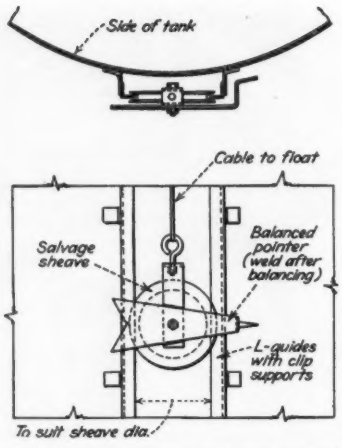
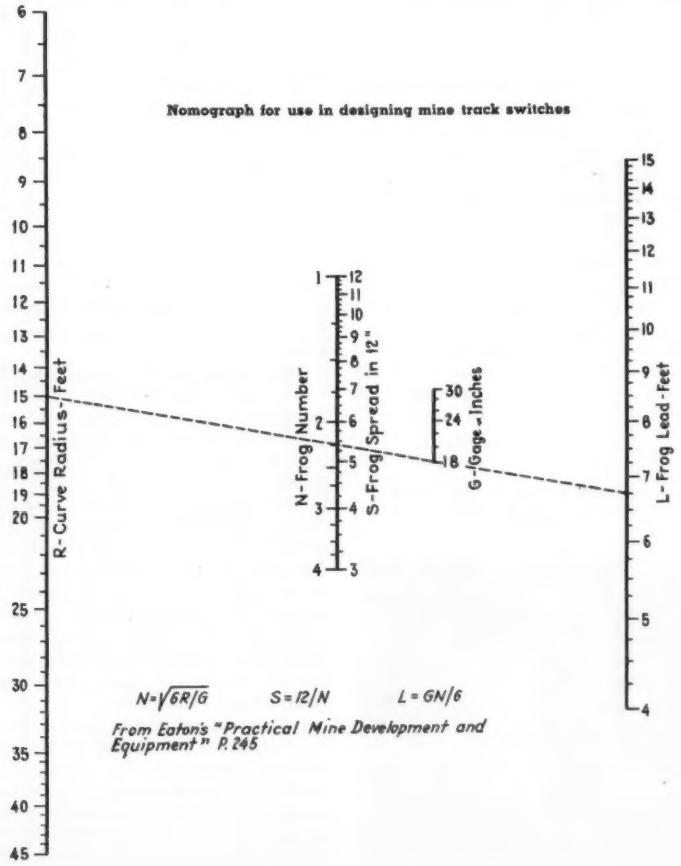
Water Tank Indicator

BINDING OR STICKING of the regulation type water-tank level indicator, operating in the usual small groove indicator board, sometimes causes considerable annoyance. This trouble has been avoided by the adoption of a device shown in the accompanying sketch, which is in use at the reduction works of the Chile Exploration Co., at Chuquicamata, Chile.



Parts and arrangement of tank-level indicator

Made up of materials readily available, it consists of a cast sheave, operating with suitable clearance between vertical guide angles, on which is mounted a steel plate pointer on the U pin-plate. The indicator works perfectly, even on the windiest days, writes Elwood Stockman, mill engineer.



Nomograph for use in designing mine track switches

A Practical Switch Nomograph

THE busy mine operator will find the accompanying nomograph a means of solving his switch problems quickly, writes R. W. Jenkins, Rio Tinto, Nev. Reference material does not cover adequately the design of switches for the narrow and sometimes odd gages and short radii of most small metal mines. This nomograph has been especially designed to meet these conditions. It may be used to determine the frog number, spread, and lead for any particular radius and track gage; or to determine the proper radius and lead from the frog spread; or, where it is desirable to have a standardized switch, to determine which frog would best fit the various radii likely to be used underground.

The length and middle ordinate of the curved lead rail are not given on the nomograph, as they are influenced by the type of points and frog used and the amount of heel spread. It is suggested that the switch be laid out on the shop floor with the proper lead after the point rails and frog have been completed to determine the curved lead exactly.

The following formulas[1], used in constructing the nomograph, have been used by me in designing several satisfactory switches and may be considered practical. For use in designing and laying out the switch the frog spread in 12 in. has been included.

N=Frog number or the length over which the frog spread has been measured divided by the spread.
S=Frog spread in one foot in inches.
R=Radius in feet.
G=Gage in inches.
L=Frog lead, or the distance from the frog point to the switch point in feet.

$$N = \sqrt{\frac{6R}{G}} \quad S = \frac{12''}{N} \quad L = \frac{GN}{6}$$

To check the solution line on the nomograph the following example will be worked:

Assume: Radius 15 ft., Gage 18 in.

$$N = \sqrt{\frac{6 \times 15}{18}} = \sqrt{5} = 2\tfrac{1}{4}\pm$$

$$S = \frac{12''}{2\tfrac{1}{4}} = 5.35''$$

$$L = \frac{18 \times 2\tfrac{1}{4}}{6} = 6.75' = 6'\,8\tfrac{1}{2}''$$

The sensitivity of the nomograph has been kept within the limits required for practical use. The frog lead may be interpolated to the inch for short radii and the frog spread is given to the quarter inch over its range.

[1] Goodman Mining Handbook, pp. 131-132, 1927.

PERSONAL ITEMS

Paul Gemmell has joined the staff of Prince Consolidated Mines, Nevada, as chief geologist.

C. B. Pengilly is directing the management of Gadzema Consolidated Mines, in Southern Rhodesia.

Robert D. Mueller, of Mariposa, Calif., is now making a survey of prospective dredging properties in the Cariboo.

Neil Munro, formerly with Kootenay Belle Gold Mines, Ltd., is now associated with the Dorr Company in Toronto.

J. A. Gladman has become mill superintendent of Nchanga Consolidated Copper Mines, in Northern Rhodesia.

Benoni Lockwood, Jr., of Tucson, Ariz., recently returned to United States after a trip to South America.

Dr. M. M. Leighton has become a member of the Advisory Committee on Metals and Minerals, OPM, Washington, D. C.

M. Spatz, 100 Pearl St., Kingston, N. Y., desires to know the whereabouts of a brother, who has been prospecting in the State of Chihuahua, Mexico.

L. M. Abell, of Mt. Morgan, Ltd., Queensland, has been appointed mill superintendent and metallurgist of the Emperor Gold Mining Co. Ltd., Fiji.

Cyril Jerrom, vice president, Chromite, Ltd., Montreal, Canada, recently returned to his office in Canada following a business trip to New York City.

C. W. Nicolson has resigned as manager of the Beck Mining Co. to become assistant manager of the North Range Mining Co. at Negaunee, Mich.

Gordon Waddell, of Boyles Bros. Drilling Co., Ltd., has returned to Singapore, after spending the summer in his native British Columbia.

G. B. O'Malley, technical representative in Australia and the Far East for American Cyanamid, Ltd., has returned to Australia from a visit to the United States.

Maxwell E. Playford, who has been assistant general manager of Mt. Morgan, Ltd., Queensland, has joined the Defense Department and will be engaged in the manufacture of munitions.

Fred W. Nobs, vice-president and manager for the Empire Star Mines Co., Ltd., at Grass Valley, Calif., lately examined cinnabar properties in north-central Nevada.

W. E. Rudolph has resigned his position as executive engineer with Certain-teed Products Corp. and has accepted a post with the Anaconda Copper Mining Co., in New York.

Walter C. Page, general manager of the Trepca Mines, at Zvecan, Yugoslavia, has been in New York since he returned to the United States on Aug. 25 last on the "S. S. Excalibur" with Mrs. Page and their nine-year-old son, after the Trepca property had been taken over

WALTER C. PAGE
Photo by Blank-Stoller, Inc.

by the Germans. Trepca is a subsidiary of the British-owned Selection Trust, Ltd., of London. Mr. Page had been in Yugoslavia with the company for ten years at the time of the seizure, having gone there in April, 1931. He was at the mine during the bombing of Belgrade on April 6. As the Germans advanced, he and his associates went down to the Dalmatian coast on the Adriatic, where they remained until that part of the country was taken over by the Italians. They then returned to Belgrade, arriving on April 29, and stayed until the closing of the American legation, when they left for Budapest. Here two and a half months elapsed before they were able to obtain transit visas from the Germans for passage across Germany, Switzerland, and "unoccupied" France and thus to Lisbon, from which port they sailed for the United States a week later, the voyage being without incident. In the same party returning were **John S. Stewart** and **Morgan Huntington,** of the Trepca organization, and their respective families. (Mr. Stewart's return was noted in the September issue.) Commenting on his experiences, Mr. Page says says that during the trip through Germany people appeared to be much depressed. Food conditions, however, seemed worse in Spain than elsewhere, with much evidence of malnutrition.

Prof. Kenneth K. Landes, until recently chairman of the geology department of the University of Kansas, has become chairman of the department of geology of the University of Michigan.

W. A. Bates, metallurgist, has joined the staff of the U. S. Bureau of Mines station at Boulder City, Nev. He will specialize in metallurgical work on manganese.

W. B. Haselton, safety director for Pickands, Mather & Co., was elected chairman of the mining section of the National Safety Council at a meeting held in Chicago on Oct. 6.

H. H. Booker, recently of the staff of Demonstration Goldfields, Baguio, P. I., has been appointed mine superintendent at Antamok Goldfields, Baguio, P. I.

C. L. O'Brien, of the Panob Gold Dredging Co., of Lincoln, Calif., is investigating placer ground in British Columbia, with a view to moving his company's dredges there.

Col. Daniel C. Jackling recently visited McGill, Nev., to inspect the copper properties, concentrator, and smelter of the Nevada Consolidated Copper Corp., leaving to attend a New York meeting of Kennecott directors.

Malcolm Moore, of Malcolm Moore, Ltd., engineers, Melbourne, Australia, has been appointed a member of an advisory committee to assist in the building of tanks, armored fighting vehicles, and other military equipment.

Arnold H. Miller, consulting engineer of New York City, who has recently been in Texas City, Tex., on professional work, has left Texas City by plane for Mexico City. He is to do examination work in Mexico.

John A. Payne, president of the Consolidated Coppermines Corp., has returned to his office at 120 Broadway after visiting for a week at the mines, now producing 9,000 tons of copper ore daily at Kimberly, Nev.

Richard C. Wells has left the Bureau of Clearance of Defense Industry Advisory Committee, of the OPM, Washington, D. C., and has returned to the Freeport Sulphur Co., after three months' leave of absence.

Anthony Strojan, Jr., of Helena, Mont., was recently elected president of the Mining Association of Montana, succeeding **Carl J. Trauerman,** of Butte, who is now secretary-manager, a newly created office.

Albert Roberts, of Summit, N. J., mining engineer and secretary of Minerals Separation North American Corp., has been elected president of United Engineering Trustees, Inc., joint agency of the national civil, mining and metallurgical, mechanical, and electrical engineering societies.

Wilbur A. Nelson has been appointed priority coordinator of mines under the OPM. Mr. Nelson is on leave of absence from the University of Virginia, where he is head of the Corcoran and Rogers School of Geology, a post he has held since 1925.

A. C. McDonald, formerly smelter superintendent at Wiluna Gold Mines, Ltd., has been appointed research metallurgist at Kalgoorlie School of Mines in succession to the late W. G. Clarke. Mr. McDonald was previously for 14 years with the Broken Hill Associated Smelters, Ltd., at Port Pirie, being assistant to **Dr. G. K. Williams** in his research

work which led to the development and installation at the smelters of the continuous refining process.

F. M. Connell has been made Deputy Metals Controller for the Dominion of Canada, and **Lieut.-Col. Ernest Hibbert** has joined the staff of the Metals Controller as technical assistant. Both are serving without remuneration or allowances of any nature.

W. Val DeCamp, manager for Cia. Huanchaca de Bolivia, S. A., on vacation leave, recently addressed members of the Crucible Club of the Mackay School of Mines of the University of Nevada at Reno, pointing to advantages of engineering positions in South America and urging student engineers to acquire a knowledge of Spanish.

L. E. Whicher, president of the Copper Canyon Mining Co., lately visited the company's Copper Canyon and Copper Basin mines, in Lander County, Nev., now operated under a lease agreement by the International Smelting & Refining Co., which has completed massive concrete work for a new deep shaft and 300-ton flotation mill.

George W. Roddewig has gone to Washington, D. C., where he will assume the post of consultant in the Zinc Section of the Office of Price Administration, Room 242. Mr. Roddewig recently arrived from Bolivia, where he was general manager at Potosi for Cia. Min. Unificada del Cerro de Potosi.

Harlowe Hardinge, president of Hardinge Co., Inc., York, Pa., has recently returned from a six weeks' trip during which time he visited the mining districts of Manitoba and British Columbia, Spokane, Los Angeles, Las Vegas, Salt Lake City, and Butte. While in San Francisco, he attended the American Mining Congress meeting.

George C. Heikes, now deputy chief of the copper, zinc, and cadmium division of OPM, on his recent return to Washington from the American Mining Congress convention at San Francisco stopped for several days at Pioche, Nev., where he was stationed formerly as district geologist for the National Lead Co. at properties of its subsidiary, Combined Metals Reduction Co.

W. B. Timm on Nov. 1 became Director of the Mines and Geology Branch of the Canadian Federal Department of Mines. He has been associated with the Department since 1913. Mr. Timm is an alumnus of Queen's University, from which institution he received his degree of B.Sc. in mining and metallurgical engineering in 1906.

Dr. T. R. Leighton, mining engineer, recently returned to San Diego, Chile, following a visit to Mexico and the United States, where he has interested mining engineers and geologists in attending the Pan-American Congress of Mining Engineering and Geology to be held in Santiago early in January 1942. While in the United States, Dr. Leighton received the degree of doctor of engineering from Lehigh University on Oct. 3.

A. J. Stromquist has been appointed safety inspector of the Cleveland-Cliffs Iron Co., with headquarters at Ishpeming, Mich. Mr. Stromquist will leave his present duties as safety inspector for the Federal Bureau of Mines at Duluth about Dec. 1.

Wayne E. (Chico) Graham, for many years aerial tramway engineer for the Braden Copper Co. at Rancagua, Chile, S. A., is now on the staff of the Department Engineer of the United States Army at Corozal, Canal Zone, and **A. M. Perdue,** after many years with Braden Copper Co. at Rancagua, has arrived in the United States to accept a position connected with the defense program.

John L. Middleton, consulting mining engineer, recently completed a visit to New York City following a five months' trip examining mines in Colombia and Peru. He and Mrs. Middleton sailed on Nov. 8, returning to Peru, where he will join with **H. Rea Beckwith,** consulting engineer, in conducting a consulting practice, advising on mining and metallurgical problems, with offices at Casilla 322, Lima, Peru.

Carl L. Wallfred has been named to the technical staff of the division of process-metallurgy research at Battelle Memorial Institute, Columbus, Ohio. A graduate of the University of Minnesota, Mr. Wallfred has had 20 years' experience in chemical and metallurgical research with the United States Bureau of Mines, the Northwest Research Foundation and Mines Experiment Station of the University of Minnesota, the Minnesota Mining and Manufacturing Co., and A. O. Smith Corp.

N. H. Bass, of Joplin, was elected president of the Southwest Missouri Chapter, Missouri Society of Professional Engineers, at an annual meeting held Sept. 30. He succeeds **George M. Fowler.** Other officers of the chapter named were **L. B. Mitchell, Jr.,** vice president, and **B. H. Rucker,** secretary-treasurer, both of Joplin. **J. J. McAfee** and **H. E. Roberts,** also of Joplin, were elected directors for a three-year term, and **Richard Jones,** of Neosho, was named for a one-year term as director. The annual meeting of the State organization was held on Oct. 17 and 18 in St. Louis.

Archer Estes Wheeler, an outstanding copper expert, was honored on Oct. 3 by the Electrochemical Society, an international association holding its 80th regular convention at Chicago. The illumined parchment scroll of honorary membership in the Society was presented to Mr. Wheeler by the president of the Society, **Raymond R. Ridgway,** of Canada. Mr. Wheeler joins a very select group of honorary members in the society composed of **Dr. Charles F. Burgess** (batteries), **Dr. Leo H. Baekeland** (bakelite), **Dr. Frederick M. Becket** (ferro-alloys), **Dr. Wilder D. Bancroft** (theory), and **Robert A. Witherspoon** (carbide). Mr. Wheeler was born at Auburn, Me., on Oct. 8, 1868, and acquired his engineering training at Massachusetts Institute of Technology. His first position was with the Boston & Montana Consolidated Copper & Silver Mining Co. at Great Falls, Mont., where he was successively promoted from mechanical draftsman to chief engineer and superintendent. In 1914 he became consulting engineer of the Union Minière du Haut-Katanga, which owns the most extensive copper deposit in the world. He has directed the design and installation of electrolytic copper refineries in Katanga; in Northern Quebec; at El Paso, Tex., at Mount Lyell, in Tasmania; in Northern Rhodesia; at Montreal East; at Outokumpu Oy, Finland; and elsewhere.

▼ ▼ ▼

OBITUARY

Herbert S. Salmon, a mining engineer of Birmingham, Ala., died in that city on Oct. 14, aged 53.

G. Percy Ashmore, internationally known as a mining engineer, died recently at Hove, England.

Harry Kauffman, a pioneer in mining in the State of Washington, died at Seattle, on Oct. 9. His age was 89.

W. A. Leddell, a consulting mining engineer of reputation and achievements, died in Wickenburg, Ariz., on Sept. 9 at the age of 60.

William G. Allen, well-known California mining man, died recently at Carmel, Calif., aged 60.

Louis Webb, retired mining engineer, formerly active in Africa, Alaska, Mexico, and the United States, died recently in Los Angeles at the age of 79.

Alexander David Crooks, first president of Teck-Hughes Gold Mines, Ltd., died in Toronto in September last. He was graduated from Toronto University in 1886.

John Dunlop Millen, who from 1906 to 1919 was manager of the famous Mt. Bischoff tin mine, at Waratah, Tasmania, died in Launceston on Aug. 1 last.

William A. Eckbert, a mining engineer who established himself in Colorado in 1877, died at Gunnison, Colo., on Oct. 27 at the age of 91.

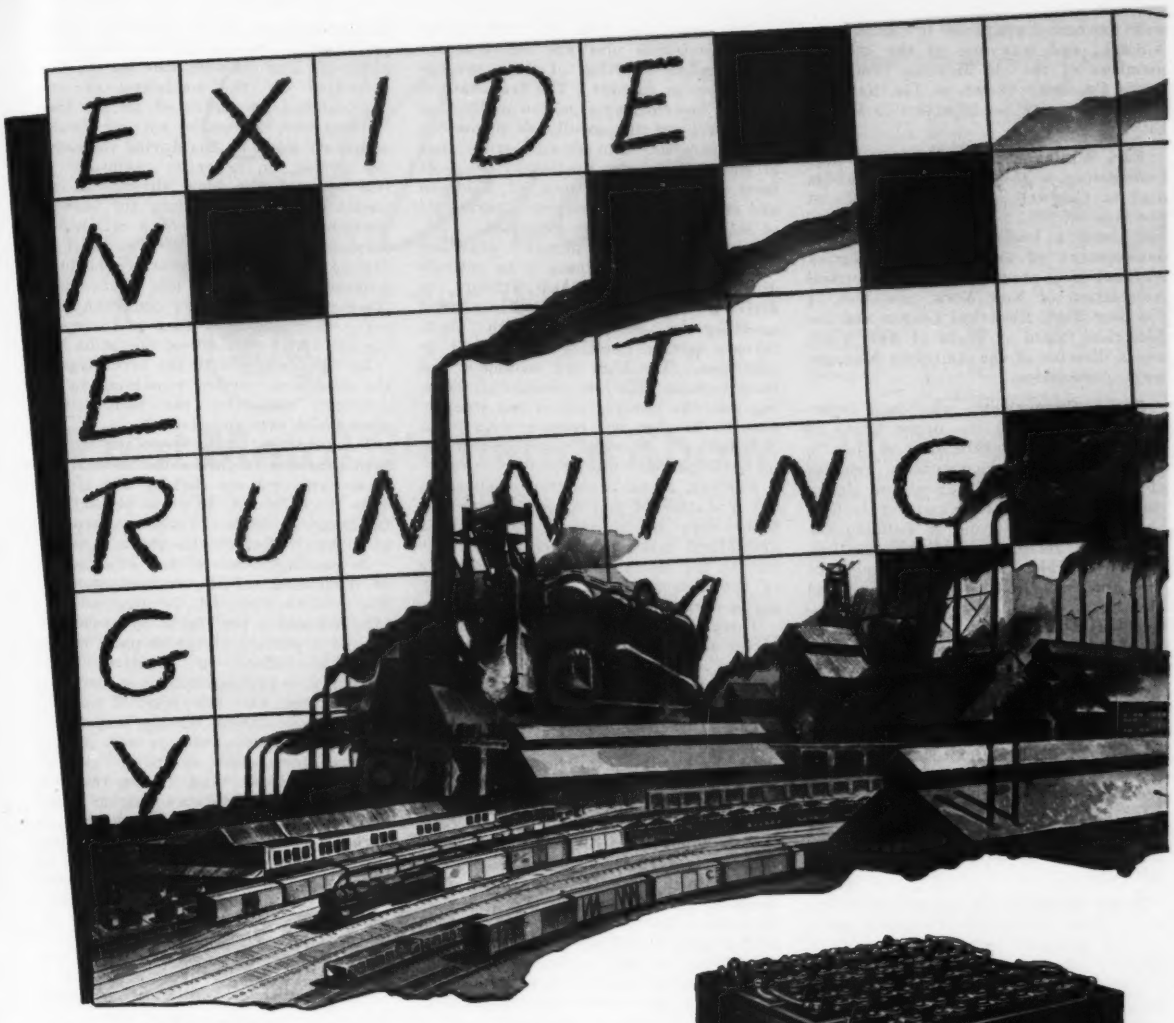
Ernest Rammelmeyer, a mining engineer active in the development of Utah from 1873 to the time of his retirement 20 years ago, died on Oct. 5 at Salt Lake City, Utah, at the age of 84.

H. Standish Ball, principal of the School of Metalliferous Mining, in Cornwall, and formerly identified with mining interests throughout the world, died at Haslemere, Surrey, England, on Sept. 26 last, age 53.

William Francis Gray, "Bill" Gray to a large section of the mining fraternity from Colorado to the Coast, died on Sept. 25 at his home in Reno at the age of 68. A graduate engineer, he had directed his energies for many years to mine promotion and management.

Charles Franklin Dike, long actively identified with mining in the Tri-State district, died at Wallingford, Pa., on Oct. 9. He would have been 65 years old on Dec. 18. He was a graduate in mining engineering at Yale and a member of the American Zinc Institute and the A.I.M.E.

Arthur Lee Lewis, 77, a well-known Arizona and Mexico mining man, died on Sept. 27 at Nogales, Ariz. Mr. Lewis



Exide is a five-letter word for DEPENDABILITY

THAT is the answer if you ask the operators of hundreds of mines and quarries who have equipped their storage battery locomotives, trammers and shuttle cars with *dependable* Exide-Ironclad Batteries.

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was for many years an ore buyer for A.S.&R., and was one of the original members of the old Mexican firm, The Lewis Co., later known as The National Metals Co., with headquarters in Mexico City.

Earl Whitehorne, editor of *Electrical Contracting,* a McGraw-Hill publication, died at Caldwell, N. J., on Oct. 23 at the age of 59. Mr. Whitehorne had long been a leader in the commercial development of the electrical industry and had been president of the Electrical Association of New York, president of the New York Electrical League and the Electrical Board of Trade of New York, and a director of the American Management Association.

Simon Guggenheim, who once represented Colorado in the upper house of the national legislature died on Nov. 3. He was 74. Mr. Guggenheim, founder of the John Simon Guggenheim Memorial Foundation, had been president of the American Smelting & Refining Co. since the retirement of his brother, Daniel, in 1919. He was a member of the American Institute of Mining and Metallurgical Engineers. An appreciation will appear in an early issue.

Prof. George R. Mickle, 78, died recently in Toronto. He retired as Mines Assessor of Toronto two years ago. Professor Mickle was a graduate of the University of Toronto in 1885 and of the School of Practical Engineering in 1888. He then spent six years of postgraduate work at Freiburg, Saxony, and later joined the faculty at Toronto University as fellow in mining, later becoming professor of mining at that institution.

David McClure, vice-president of the Gwin Mine Development Co. and director of the Kennedy Mining Co. died on Aug. 5 at the University Club, San Francisco, where he had been domiciled for many years. He was born in Martinez, Calif., on Aug. 17, 1856; completed his education at Lafayette University; joined the American Institute of Mining and Metallurgical Engineers in 1900; and for many years was a successful operator of mines on the Mother Lode. Later, in connection with professional work he made journeys to Europe, eastern Asia, and South America.

▼ ▼ ▼

LETTERS

Converter Smelting

The Editor:

FREQUENT REFERENCE has been made to the possibility of utilizing the oxidizing heat of sulphide copper ores for the purpose of ore smelting in some type of modified converter. Yet little progress has been recorded in this branch of metallurgy.

The original experiments of John Hollway with smelting Rio Tinto sulphide ores in a steel converter at Pennistone, England, in 1878, established two facts: First that copper mattes may be successfully refined by the bessemerizing process in the converter, and second, that the inherent fuel values of the sulphide ores are sufficient for the complete smelting of these ores in the converter furnace. The first feature, that of bessemerizing molten matte, has been developed successfully as to method and apparatus. The second feature, that of smelting ores in the converter, aside from the successful work of Knudsen and erratic and inconclusive experiments of later date, has been neglected.

Pyrite smelting as formerly practiced in the shaft blast furnace is an entirely different procedure. Any attempt to arrive at an understanding of converter smelting by comparison with blast-furnace pyrite smelting will result in confusion. The high ore column of the blast furnace with low-pressure air blowing into the glowing ore is not comparable to the low ore column with high-pressure air blowing into the molten material in the converter.

Further, actual converter smelting is not a matter of adding concentrates or other ores to a charge of partially devitalized matte from another furnace but is the actual smelting of raw ore in the converter upon a bath of fiery matte derived from a sulphide charge.

There is more similarity between converter smelting and reverberatory smelting as at present practiced. In both there is the low ore column, batch smelting, periodic skimming, and tapping of matte. One may even refer to converter smelting as a species of reverberatory smelting in which the heat required is furnished, not by a flame from above, but by the heat furnished by the oxidizing sulphides within the molten bath.

It is true that the quiescent melt-down procedure of reverberatory smelting differs from the agitated and much more chemically active bath in the converter. However, the difference in chemical action upon the different components of the charge is only in degree, with the advantages in favor of converter smelting. Here the various smelting operations—i.e., roasting, smelting, and a degree of refining—are combined in one operation in an economical and expeditious manner. One can visualize that such smelting would mark an advance comparable to the advantages of the converter refining of matte over the old Welsh process.

If asked to explain my ideas as to converter smelting, I would say that these ideas, which differ from those of Knudsen as to method, are best expressed by reciting Claim 2, U. S. Patent 2,105,574. It would be more desirable to leave patent matters entirely out of the discussion, but inasmuch as this concisely worded paragraph represents five years of effort before the U. S. Patent Office to express these ideas, I believe the inclusion is excusable. This claim is as follows:

"2. A process of smelting sulphide ore which comprises periodically introducing a charge consisting of small amounts of a mixture of sulphide and siliceous flux, the flux being sufficient in amount to slag the iron oxide formed in converting the sulphide ore until enough has been introduced for one blow for matte and slag production; the charge being introduced upon a nucleus of molten matte in a container provided with means for injecting air into the charge contained therein, the matte being sufficient in amount to cover the air injecting means; periodically smelting the mixture of sulphide ore and siliceous flux by the heat generated by the oxidation of iron and sulphur by means of an air blast injected into the matte, without further additions of ore or flux during the smelting period, in order to maintain the full heat of the blow throughout the smelting period; repeating the periodic charging and smelting of a mixture of sulphide ore and siliceous flux until the desired quantity of matte is obtained; separating a portion of this matte, maintaining it in its molten condition; and using the same as a nucleus in repeating the above sequence of operation."

In the analogy with the reverberatory the separated portion remaining in the converter comprises the molten bath upon which ores are smelted.

I believe that enough explanation has been provided to invite discussion. The ideas expressed are sketchy and simple. This must be so, to first present the fundamental ideas. Further discussion as to detail operation is another matter.

In passing, however, two details may be mentioned. First, concentrates and fine material should be agglomerated (not roasted), preferably by sintering; loss of a portion of the sulphur has no noticeable effect on smelting heats. Second, it is preferable to heat the silica flux charged, with the object of approximating a continuous fluxing heat within the furnace to maintain as near as possible simultaneous oxidizing (of the molten sulphides) and fluxing reactions to prevent accumulation of higher oxides of iron during a lengthy heating-up period. The first may be made to include the second to the advantage both of the quality of the sinter and absorbed heat of the silica flux. F. E. WING

Tacoma, Wash.

"Analyzing Results of Mining Enterprises"

The Editor:

WITH REFERENCE to the July *Engineering and Mining Journal* article "Analyzing Results of Mining Enterprises," it has been asserted that "extraction" or "tailings loss" was not considered. This important phase of operations, however, is embraced in the "grade of ore" factor, which may be split into two main contributory factors—namely (1) gross value of crude ore before treatment, less (2) values lost in the treatment process. This factor might also be divided into three instead of two subfactors—namely (a) metal content of the crude ore; (b) amenability to treatment—the "extraction" or "processing efficiency" factor; and (c) prices of the metals. Each of these are in turn divisible and redivisible into still further factors.

The emphasis in the article was on *methods* and *procedures* to show the extent to which operating results could be usefully integrated and synthesized. The purpose was not to mention nor to catalog all the operating subfactors ultimately having a bearing on the "common denominators"—viz.: volume of ore, grade of ore, and operating economy.

DIXON FAGERBERG, JR.

Phoenix, Ariz.

What Metal Statistics Show

GREATER PRODUCTION of copper, lead, and zinc is urged by Washington officials to meet the ever-growing needs for all-out defense. The announcement of a higher price for zinc has encouraged more development and exploitation of zinc mines, with the result that output will soon respond to such action. In copper, the OPA has approved six months' contracts signed by the Procurement Division of the Treasury with Copper Range Co., Quincy Mining Co., and Isle Royal Copper Co., all in Michigan. Purchase of their copper will be the equivalent to "out-of-pocket costs" adjusted to include a wage increase of $1 per day, plus an additional cent a pound if the total price per pound is lower than the cost of production during the six months' contract period. On the other hand, if the out-of-pocket cost is lower during the contract period than the adjusted cost of production for the period Jan. 1 to June 30, 1941, the price to be paid will be the cost of production during the contract period plus 50 percent of the difference between the periods. In no case will the price per pound exceed the 15c. and 16c. contract maximums.

Lead producers received the following telegram from OPM on Nov. 7th: "The urgency of the defense program requires that your mining properties be operated at maximum producing capacity 24 hr. a day six days a week and, where possible, seven. You are requested to take all necessary steps to this end and if necessary to acquire such additional equipment to improve the operating conditions of mines that will result in increased production. Please advise us if we can be of any assistance."

The telegram was signed by W. S. Knudsen and Sidney Hillman.

Stocks of refined copper (duty-free metal) amounted to 63,670 tons at the end of September, a reduction of 8,260 tons for the month.

The Institute's figures for August and September, in tons, follow:

	Aug.	Sept.
Production:		
Crude	(a)84,695	82,071
Refined	85,426	80,961
Deliveries, refined:		
Domestic customers (b)	(a)117,486	120,429
Export	.....	.....
Totals	117,486	120,429
Stocks at end, refined.	(a)71,930	63,670

(a) Revised. (b) Includes duty-paid foreign copper.

▶ LEAD—Statistics covering lead refined in this country for the months of August and September, in tons, according to the American Bureau of Metal Statistics, follow:

	Aug.	Sept.
Stock at beginning	19,172	15,330
Production:		
From domestic ore	39,100	41,373
Secondary and foreign	12,057	3,530
Totals	51,157	44,903
Domestic shipments	55,005	47,093
Stock at end	15,330	13,148

▶ MANGANESE — Domestic production of manganese ore containing 35 percent or more manganese during the month of August was 9,100 long tons, which compares with 6,000 tons in July and 4,600 tons in June, according to monthly survey by the Bureau of Mines.

General imports of metallurgical manganese ore, comprising ore received in this country, amounted to 65,381 long tons during July, which compares with 65,382 tons in June. General imports for July, by countries of origin, in long tons, were as follows:

From:	Gross Weight	Manganese Content
Belgian Congo	8,036	4,018
Brazil	15,591	6,842
Cuba	15,595	7,483
Gold Coast	9,950	5,377
Mexico	94	43
Netherlands Indies	1,098	571
Philippines	2,116	1,028
Union of South Africa	12,901	5,779
Totals	65,381	31,141

▶ CHROME ORE—Imports of chrome ore for domestic consumption during July, accordnig to the Bureau of Foreign and Domestic Commerce, follow:

From	Gross Weight, Long Tons	Chromic Oxide Content, Long Tons
Canada	1	1
Cuba	17,593	5,698
Brazil	150	75
Philippines	12,121	4,740
Turkey	5,000	2,400
French Oceania	12,067	5,852
Union of S. Africa	7,383	3,249
Other Br. S. Africa	16,824	8,087
Other Br. W. Africa	3,200	1,514
Totals	74,339	31,616

▶ QUICKSILVER—Mercury production at domestic mines in August amounted to 4,100 flasks, 100 flasks above the rate for June and a new high monthly rate for many years, probably since the period of the country's greatest output, 1875 to 1883, according to the Bureau of Mines, United States Department of the Interior. Compared against the large rise in production in June, when rich strikes in a limited area caused the increase, the advance in August was shared by a number of properties scattered over a wide area. Consumption also increased, 3,300 flasks (corrected figure) in July against 3,600 in August.

Quicksilver statistics for the first eight months of the current year, in flasks of 76 lb. follow:

	Production	Consumption	(a)Stocks
January	3,100	2,900	14,100
February	2,900	4,700	12,100
March	3,500	4,000	11,600
April	3,500	3,200	11,700
May	3,600	3,500	10,700
June	4,000	3,300	11,400
July	3,400	3,300	11,700
August	4,100	3,600	11,600

(a) Consumers' and dealers' stocks.

▶ ZINC—The domestic zinc statistics (all grades) for September and October, according to the American Zinc Institute, follow:

Production of Prime Western and other grades for September, follow:

	Sept.	Oct.
Stock at beginning	17,969	19,427
Production	73,225	75,980
Total	91,194	95,407
Production daily rate	2,441	2,451
Shipments:		
Domestic	64,673	61,483
Foreign (drawback duty)	7,094	12,330
Total shipments	71,767	73,813
Unfilled orders	67,079	62,559
Stock at end	19,427	21,594
Prime Western	30,796	29,730
Select	1,456	1,456
Brass Special	5,570	7,567
Intermediate	4,548	3,596
High Grade	14,503	17,553
Special High Grade	16,352	16,078
Total	73,225	75,980

▶ MAGNESIUM — The Defense Plant Corp., RFC subsidiary, has arranged a $28,317,000 financing program for the construction of two magnesium plants that will add 60,000,000 lb. to the annual capacity to produce the metal.

The Mathieson Alkali Works is to receive $16,000,000 to build a plant at Lake Charles, La., to produce metallic magnesium at the rate of 36,000,000 lb. a year.

The other plant is to be constructed by the International Agricultural Corp., at Austin, Tex., at a cost of $12,317,000. Capacity will be 24,000,000 lb. a year.

So far, the Defense Plant Corp. has financed expanded magnesium production totaling about 300,000,000 lb. annually. Financing the construction of additional plants other than those above is expected to be announced soon.

E & M J Weighted Index of Non-Ferrous Metal Prices

(100 is composite for 1922–3–4)

1929	110.33	1935	74.66
1930	82.87	1936	73.45
1931	60.20	1937	90.86
1932	48.26	1938	73.67
1933	59.79	1939	77.71
1934	69.59	1940	79.22

	1939	1940	1941
January	77.12	80.85	82.48
February	76.89	77.23	82.76
March	77.00	77.94	83.27
April	74.79	77.19	83.48
May	73.61	77.68	83.48
June	73.17	78.85	83.51
July	71.95	76.72	83.60
August	73.88	76.71	83.39
September	83.07	79.40	83.34
October	84.25	82.49	83.84
November	83.80	83.14	....
December	82.89	82.42	....

CALIFORNIA

Nation's Largest Tungsten Mill Starts Operations

Plant near Bishop is treating 1,300 tons of complex tungsten ore per day

▶ One of the largest tungsten deposits in the world is now under development by the United States Vanadium Corp. near Bishop, Calif. This corporation has just completed a new mill of 1,300 tons per day capacity, which replaces the present 500-ton per day mill, which has been operating for several years on Pine Creek, a tributary of the Owens River, on the eastern slope of the Sierra Nevada Mountains.

The new plant is 21 miles from Bishop. The mine, which has been under development for the past four years, is a large contact metamorphic type of deposit containing tungsten as scheelite, molybdenite, and copper-silver, is operated on a sublevel caving system, using long diamond drill holes for blasting from sublevels. Ore is hauled by a 5-ton electric storage-battery locomotive, in 10-car trains, using 3-ton Granby-type side-dump cars, to a crushing plant at the mine portal consisting of a 20-in. gyratory crusher set to crush to 4-in. size at the rate of 160 tons per hour. Crushed ore from the crushing plant bins is conveyed by a three-section aerial tramway, 11,000 ft. long, with a capacity of 100 tons an hour, to the new mill location, 3,000 ft. below the mine portal. The buckets from the tramway discharge into a lower tramway bin, where the ore is fed by a pan feeder to a Symons 5½-ft. short-head crusher set to a ¾-in. opening. This crushed ore is conveyed to four 1,200-ton circular steel storage bins over a Merrick weightometer for the recording of tonnage.

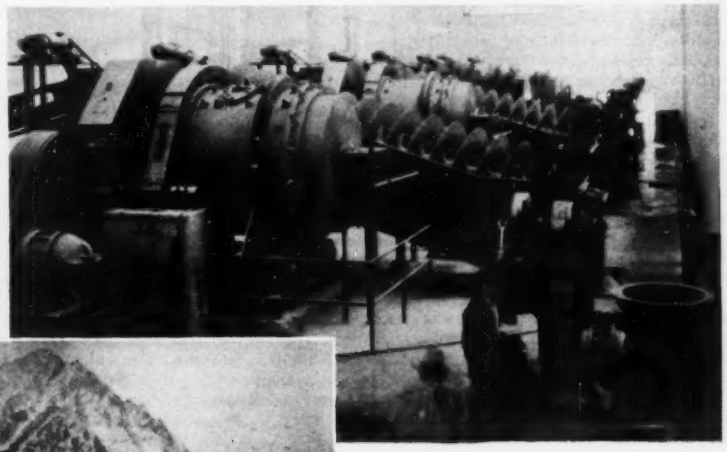
The mill is arranged in four separate sections. In each section the ore is fed to a 6x5-ft. Marcy ball mill of the open-end type, in closed circuit with a 60-in. Akins classifier. The ore is ground to approximately 90 percent minus 60 mesh, and goes to the flotation machines at a pulp density of 25 percent solid.

Each flotation section consists of three 10-cell, 18-in. impeller Mineral Separation Type Stearns-Roger flotation machines. Sodium silicate, pine oil, and xanthate are added and a bulk concentrate containing 20 percent MoS_2, 20 percent copper, and 30 oz. of silver is removed. This bulk concentrate goes to a cleaner circuit, where the sulphide flotation reagents are removed with steam, and the molybdenite and copper-silver are separated in a cyanide solution which depresses the copper-silver.

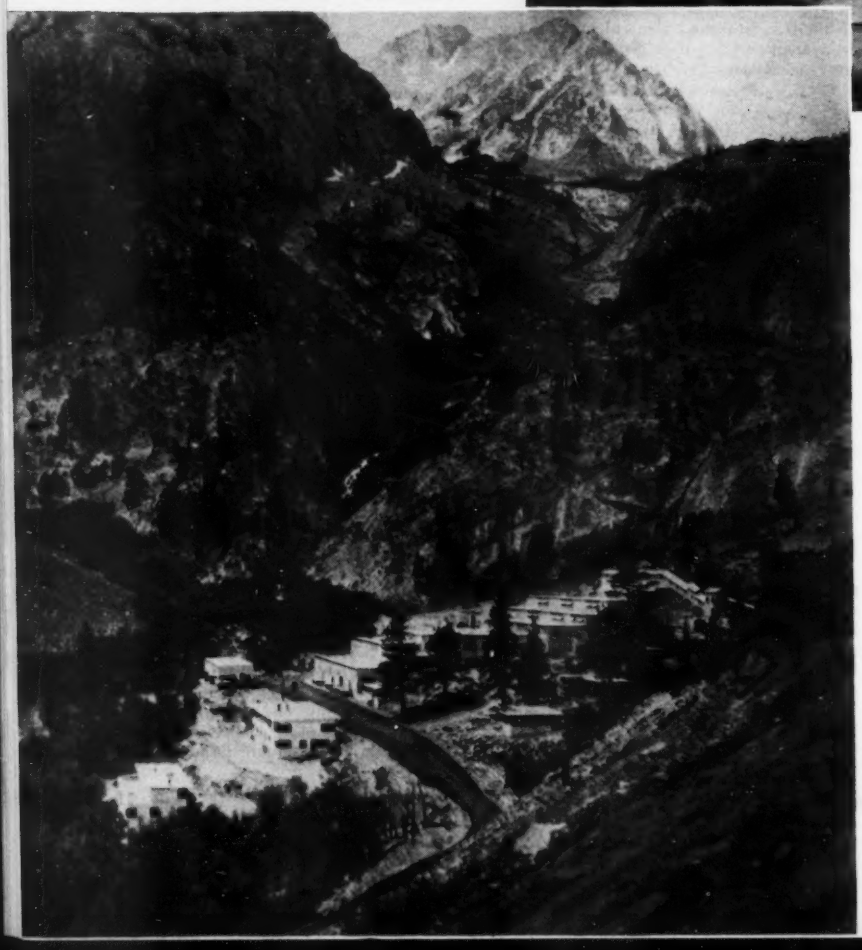
Following the first sulphide flotation cells, the ore pulp is divided into the two remaining banks of cells, in which cresylic acid, emulsol, and sodium oleate are added to float scheelite, and the flotation tailings pass to the tailings launder over pilot tables.

Following the scheelite flotation step, the tungsten flotation concentrates are handled by gravity to a chemical treatment unit for the recovery of tungsten. The unit consists of continuous-pressure autoclaves in which the tungsten concentrates are treated with steam and sodium carbonate. By this method the tungsten is separated from the concentrates as soluble sodium tungstate, and after undergoing a purification process, is precipitated as synthetic scheelite of a marketable grade.

The Pine Creek chemical process is the result of four years of research on the complex Pine Creek ores, and has been successful in producing a high-grade, marketable product directly from low-grade scheelite flotation concentrates.



Four open end Marcy ball mills in closed circuit with 60-in., Akins classifiers are set to deliver minus-60-mesh product



This modern concentrating and chemical treatment plant of the U. S. Vanadium Corp. is at an elevation of about 7,700 ft., at the junction of Pine and Morgan Creeks near Bishop, Calif. The mine is two miles up the canyon

In addition to the treatment of tungsten ores from the mine at Pine Creek, the United State Vanadium Corp. has been applying the process developed to the treatment of similar tungsten concentrates from various nearby mines, and a large amount of tungsten is being produced as a result of the beneficiation of concentrates from other flotation mills.

The United States Vanadium Corp. is a unit of the Union Carbide & Carbon Corp., with head offices at 30 East 42d St., New York, N. Y. J. R. Van Fleet is vice president. Blair Burwell is general superintendent. W. G. Haldane is assistant general superintendent. M. N. Shaw is superintendent of the Bishop unit. C. C. Sterns is superintendent of the Rifle unit, in Colorado. A. F. Coleman is superintendent of the Uravan unit, in Colorado. S. P. Warren is superintendent in charge of metallurgical operations at Uravan. Thomas W. Brock is master mechanic at Rifle and Uravan.

COKING COAL

SINCE the day the idea was conceived of using air bubbles for carrying the mineral particles to the surface of the ore pulp, research men have experimented with an untold number of possible flotation reagents. Included among these materials are Coal-tar Creosotes, obtained by coking coal. While these materials are still being used in considerable quantity, the tonnage of ore floated with Xanthates today is many times that treated with all other collector reagents combined.

Technicians from the Great Western laboratories made an extensive study of Xanthates and those carrying the Bear Brand label are the result of this research.

Currently there are seven distinct types of Bear Brand Xanthates, each with its own special recovery characteristics. These products of chemical science meet practically every requirement for the successful treatment of sulphide and metallic ores. Mining men throughout the world know they can depend on a consistent uniform quality, purity and exceptional stability.

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3	Z3—Potassium Ethyl Xanthate	4	Z4—Sodium Ethyl Xanthate	5	Z5*—Potassium Amyl Xanthate	6	Z6*—Potassium Pentasol Amyl Xanthate	8	Z8—Potassium Secondary Butyl Xanthate	9	Z9—Potassium Isopropyl Xanthate	10	Z10—Potassium Hexyl Xanthate

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▶CALIFORNIA

▶ Red Canyon Mining Co. has started production at its Red Rock quicksilver property near Solvang, Santa Barbara County, following erection of a 40- to-50-ton Gould rotary treatment plant. The mine has produced fairly steadily under different operators since 1932, and the furnace and condenser equipment installed is that formerly used at the J. O. Greenan quicksilver mine, in the Bottleneck district near Winnemucca. Operations are directed by W. G. Donaldson.

▶ Dewatering of underground workings and shaft preparatory to resumption of mining is nearing completion at the Mountain King mine, in the Copperopolis area near Hodson, Calaveras County. Until operations were suspended by litigation several years ago, the mine produced steadily. Current rehabilitation work is being directed by Byron Rowe, manager.

▶ Rustless Mining Co., H. F. Byram, vice president in charge of California operations, has completed plans for early erection of a mill capable of handling some 200 tons of chrome ore a day at its holdings near Chrome, Glenn County. The property has been under examination and development for more than a year. The company also operates chrome mines in the Nigger Hill area of El Dorado County.

▶ The first single-bucket Becker-Hopkins dredge constructed by Yuba Manufacturing Co. of San Francisco for use in California has been placed in operation on Butte Creek near Chico, Butte County, by Piedmont Dredging Co., C. A. Palmer, president. Other work completed by the company recently included erection of a camp and improving roads leading to the dredge site.

▶ Installation of a 60-ft. headframe, hoist, and other surface plant equipment has been completed at the St. John mine, near Grass Valley, Nevada County, with the main shaft dewatered to a depth of 300 ft. The property is controlled and operated by E. C. Jacobs, and was reopened several months ago.

▶ Rehabilitation work and development are proceeding according to schedule at the Plumas-Eureka mine, near Johnsville, Plumas County, operated by Portola Corp. Retimbering of the Mammoth tunnel is progressing steadily, and at the treatment plant a 20-ton Straub mill is being installed to handle clayey gold-bearing material found in sections of the mine. Power facilities will be enlarged by addition of a 180-hp. diesel engine and a Caterpillar diesel unit to the 60-hp. hydro-electric plant now available. Operations are directed by Gail Hare, vice president.

▶ The McCormack chrome mine, near Jamestown, Tuolumne County, has been taken over by the Ellis Engineering Co., of San Francisco, and early production is planned. The company also operates the Comet and Gospel gold properties, in Calaveras County. At the McCormack, the 185-ft. shaft has been dewatered, and active exploitation of a body of chrome ore is under way.

Standard Cyaniding Co. is treating around 600 tons of gold ore from its open-pit Gold Standard mine in the above cyanide mill near Lovelock, Nev. The plant also contains a sand-leaching and slime-treatment section

NEVADA

3,000,000 Tons Manganese Ore Estimated in Wash District

Bureau of Mines announces manganese content will average 18 to 20 percent—Large plant to be built for recovering magnesium

▶ Correction. On p. 78 of *E. & M. J.* for October, 1941, we published information released by the Bureau of Mines to the effect that a million tons of ore containing more than 10 percent manganese was available in the Wash mining district near Las Vegas. At the request of the Bureau we make the following correction: "Bureau engineers have estimated that nearly 3,000,000 tons of ore is available which at a cutoff grade of 10 percent manganese will average 18 to 20 percent manganese."

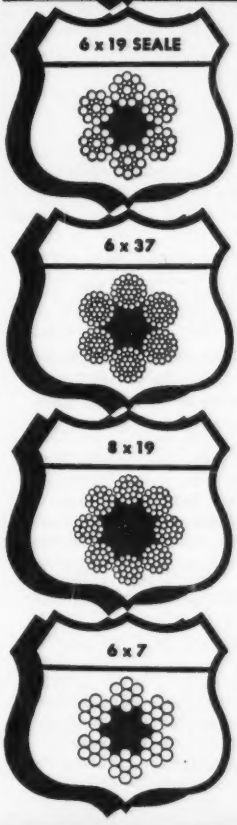
▶ A contract for construction of a magnesium oxide plant near magnesite deposits in the Mammoth district in northwestern Nye County that are to supply the $63,000,000 magnesium metal plant of the Basic Magnesium, Inc., near Boulder Dam has been awarded the Macdonald Engineering Co., of Chicago. The plant, 32 miles northeast of Luning, the rail point, will cost approximately $3,000,000 and will include crushing, grinding, and flotation units and a calcining furnace. J. W. Macdonald, head of the contracting firm, has started camp construction. Designing of the 2,000-ton per day plant has been assigned to the Southwestern Engineering Co., of Los Angeles. Completion of the plant will require around ten months' time with 400 men employed, and the plant is expected to be operating in December, 1942. N. B. Thomsen is manager for the contractor; Walter Patnoe, of Cleveland, chief engineer for Basic Magnesium, Inc., and Harley C. Lee chief chemist. E. F. Raeside will be superintendent of construction. These men, together with C. H. Shattuck, vice president, and E. R. Cullity, mining department manager, of the Southwestern Engineering Co., lately inspected the plant site near Mammoth, at the head of Gabbs Valley. Shipments of magnesite from this point to the new Permanente Corp. plant at Los Altos, Calif., are now 300 tons per day.

▶ In a report to stockholders, L. E. Whicher, president, Canyon Copper Co., said that progress at the mine, under the lease and option agreement with the International Smelting & Refining Co., has been eminently satisfactory. It is estimated that more than $400,000 has already been expended in surface equipment and underground development and that upwards of $200,000 additional will be required to complete the plans to place the property in operation. The 350- to-400-ton mill to treat the copper ore is expected to be in operation soon.

▶ A 300-ton cyanide mill operated heretofore by the Willow Creek Mines, Inc., at French Gulch, Shasta County, Calif., has been acquired by the Goldacres Consolidated Mining Co., and the equipment is being moved to the latter's low-grade gold property in the Tenabo district in Lander County, Nev. Added equipment will provide capacity of 400 tons per day. A reserve of 500,000 tons of $6 gold ore is said to have been developed. Harry C. Bishop, of Denver, is president and A. E. Moynahan is directing engineer, receiving mail at Beowawe, Nev.

▶ On the 7,000-acre property of the Greenan Placers, Inc., in and below Copper Canyon, Lander County, the Natomas Company is assembling equipment of a dragline with 6-cu.ft. bucket and gravel-washing plant purchased from the Ferris Gold Dredging Co. and until recently handling 7,000 cu.yd. of gravel per day in the John Day district of Oregon. Test work by drilling and shafts sunk to bedrock has indicated 60,000,000 cu.yd. of 20c. gravel or better. Trevor Sanks, of Battle Mountain, is in charge for the Natomas Company.

▶ Claims in the Manhattan district, Nye County, that have been productive, including the Dexter, Verden, and Midas groups, together with the 50-ton War Eagle cyanide mill, have been acquired from Matt Kane, district pioneer, by the Jefferson Lake Sulphur Co., of New Orleans, La. The mines and mill had been operated for several years until



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recently by the Reliance Mining Co., with H. R. Van Wagenen managing engineer. Robert W. Prince is engineer in charge for the Jefferson Lake Sulphur Co.

▶ Production of talc in the old Palmetto district in Esmeralda County, near the California line, has attained record proportions in this long-abandoned district. More than 100 men are employed on a half-dozen properties, several of which have been purchased from local prospectors and Indians. The product is trucked to California points for use in defense industries.

▶ Construction of a 200-ton cyanide mill is near completion on the property of the Marigold Mines, Inc., 6 miles south of Valmy, a station on the Southern Pacific main line in southeastern Humboldt County. Gold ore will be mined both underground and by power shovel from an open cut. Lou M. Louis is in charge and Frank E. Horton, with office at Winnemucca, is president and general manager.

▶ Old mine dumps at the Northern Belle and Holmes mines of the Argentum Mining Co., of Nevada, in Mineral County, have been sampled for the American Smelting & Refining Co. and may be shipped to the Garfield, Utah, smelter to meet the current demand for siliceous ore. Fred G. Grube is president of the Argentum Co.

▶ A small mill, equipped with crusher, rolls, and vibrating screen, is producing scrap mica in the Ruby range in southern Elko County. Near the mica deposit, reported to be of great extent, a shallow tunnel is said to have exposed beryl, some of the crystals two inches thick. California men are associated with W. E. Culver, of Reno, in the operation.

▶ At the 1,000-ton cyanide mill of the Getchell Mine, Inc., in eastern Humboldt County, arsenic is now recovered by a baghouse unit from arsenical sulphide ore, orpiment and realgar, roasted at around 1,200 deg. F. in two 260x7½-ft. rotary kilns before entering the cyanide circuit. Until recently arsenic went to waste. Fred Wise is general superintendent.

▶ A lease on two sections or a solid tract of 1,280 acres of the 7,290-acre placer property of the Sawtooth Placer Syndicate in the Sawtooth district, southern Humboldt County, has been granted by O. E. Chaney, of Reno, syndicate president and manager, to Owen Sullivan, of Reno. Under its terms Eastern associates of Sullivan are to install and operate a 5,000-cu.yd. dredge within three months.

▶ Molybdenite sampling 2 to 3.2 percent has been found in sinking a 100-ft. shaft on property of the Golden Ensign Mining Co., adjoining the Rio Tinto mine of the Mountain City Copper Co. in the Cope district, northern Elko County. The ore, containing some gold and silver, is in a bedding plane in limestone. A. S. Easton, of Salt Lake City, is manager. Molybdenite is exposed at several points on claims in the Elk Mountain district, 25 miles east of Mountain City, owned by John Robinette, of Hailey, Idaho.

View of power plant and 300-ton flotation mill of the Bagdad Copper Corp., near Bagdad, Ariz. An RFC loan of $2,500,000 has been approved for this company for expansion of operations.

ARIZONA

Some Copper Mines Plan Increased Output

RFC authorizes loan to Bagdad Copper Corp. for expansion and recommends loan to Castle Dome Copper Co., a subsidiary of Miami Copper Co.

▶ On Oct. 18 Jesse Jones announced that the RFC had authorized a loan of $2,500,000 to the Bagdad Copper Corp., Hillside, Ariz., for mine development and expansion of the company's mill.

▶ OPM has recommended to RFC that funds be made available to Castle Dome Copper Co., Miami, Ariz., for developing a low-grade deposit to produce 23,000 tons of copper a year. The company is owned by Miami Copper. The property lends itself to open pit operation.

▶ Magma Copper Co., operating in Arizona, produced 13,133 tons of copper during the first nine months of 1941. The average net selling price was 12.0692c. a pound and the average net production cost per pound was 7.9779c. The production cost does not include the allowance for mine depletion, capital-stock tax, federal income tax, or excess-profit tax.

▶ The Davenport Milling & Reduction Co. has stepped up its mill to 125 tons per day and a good zinc separation is being made. The plant will also handle custom ores from the many small properties in the district. C. F. Weeks, of Kingman, is engineer in charge.

▶ The old Hilltop mine, which has been idle since 1928, is back in production. O. O. Mattox, owner of the property, is working about ten men and several shipments running high in lead, zinc and silver have recently been made to the smelters.

▶ Geronimo Gold Mines, Inc., operating the old McGuire gold property three miles southwest of Kingman, is getting its mill into operating condition and expects to begin production in the near future. C. D. Wilkinson of Kingman is in charge of operations.

▶ A 100-ton pilot mill is expected to be constructed soon at the Sheep Tanks mine, 20 miles south of Vicksburg. Mill samples tested at the U. S. Bureau of Mines at Salt Lake City have produced an economical flowsheet for the handling of the ores. It is expected that later the plant will be increased to a capacity of 1,000 tons daily. The principal values are in gold and silver, but the present processes are expected to recover the manganese content. Edwin W. Mills, of Salome, Ariz., controls the property.

▶ The Calistoga Mining & Development Co., operating the Grand Reefe mine, near Klondyke, Ariz., is shipping about 6 tons of concentrates daily to El Paso, Tex., by truck. The 100-ton mill has been completely overhauled and is expected to take ores from the mine as soon as the tailings dumps are finished. J. Robert Clarkson, of Klondyke, is general superintendent.

▶ The Santa Maria Mining Corp. is employing a dozen men in its mine work near Dos Cabezas, and the mill is being enlarged to handle 35 tons daily. Ben Ross, 404 Heard Building, Phoenix, is president.

▶ Wooten and McGavan, of Duncan, are operating under lease the Hardy manganese property three miles north of Ash Peak, near Duncan. They are averaging one ton daily of a mangenese ore that averages 44 and 48 percent. Only three men are employed, but it is planned to increase production soon.

▶ A. F. Mercier, of Wickerburg, and associates, have leased the South Vulture mine and are working about ten men on the property. The mine is opened principally by a 200-ft. shaft and several hundred feet of drifts.

▶ The Boulder Mining Co., Hillside, is shipping from 15 to 20 cars of ore and concentrates monthly. A new loading device hase been installed whereby concentrates can be handled in bulk, substituting the work of sacking heretofore employed. The principal values are in gold and silver. Some zinc is also being recovered. Pitt F. Hyde is general manager of the company.

▶ The large flow of water that inundated the 2,680- and 2,565-ft. levels of the Denn mine of the Shattuck Denn Mining Corp., on Aug. 30, has been all removed except about 35 ft. Normal mining operations have been suspended pending the dewatering, but limited work in mining and development has been maintained on the higher levels. Thomas Bardon is president of the company and J. A. Wilcox is superintendent. This

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▶ARIZONA

large flow of water originally broke into the lower workings of the Junction mine of the Phelps Dodge Corp., near Bisbee, and seeped into the workings of the Denn mine near by. Clean-up operations are now under way at both properties. The 100-ton lead-zinc Shattuck Denn concentrator at Bisbee has been accepting custom ore to determine how much production can be made from small properties in the district.

▶ The Southern California Mineral Co., of Los Angeles, is shipping several cars of perlite from newly opened properties in Mohave County situated 7 miles west from Franconia station of the Santa Fe railroad, 30 miles southwest of Kingman. P. E. Thomas is president of the California company and is associated with Walter Skeoh in the operation of the property.

▶ Emery Blevins, operating placer properties in the Lost Basin district in Mohave County near the old King Tut workings, is meeting with good success. Besides the usual gathering of fine gold, several nuggets have been found valued at $25 and $40. Recently T. P. Duncan found a nugget valued at $140 on a nearby property.

▶ Securities and Exchange Commission has issued a stop order suspending the effectiveness of the registration statements of Comstock-Dexter Mines, Inc., an Arizona corporation owning mining properties in Yavapai County. The commission found that the registration statements "include untrue statements of material facts and omit to state material facts required to be stated therein and material facts necessary to make the statements therein not misleading."

UTAH

Murray Lead Smelter Resumes Operations

Accumulation of foreign lead concentrates now ample to maintain production until next summer—Kalunite Inc. will erect alumina plant in Utah

▶ Operations were resumed at the Murray lead smelter of the American Smelting & Refining Co. on Oct. 4 after a two-month shutdown resulting from lack of ore caused by an interruption in shipments from Australia and South America. About 300 men were reemployed. General Manager W. J. O'Connor believes that large enough stockpiles have been accumulated during the interim to maintain operations until next summer.

▶ Kalunite, Inc., of Salt Lake City, has been authorized by the Defense Plant Corp. to erect an alumina plant in Utah. The sum of $1,500,000 will be used for plant construction and $500,000 for the exploitation of alunite deposits near Marysvale, Piute County. Frank Eichelberger is president of Kalunite, Inc., with offices at 323 West 8th Ave., Spokane, Wash. A plant to make aluminum from the alumina produced from this Utah operation will be erected in Tacoma, Wash., by the Olin Corp., for which the Defense Plant Corp. has authorized around $4,000,000 for completion. Senator Abe Murdock, commenting on the new development, stated that the signing of the contracts will enable the mining of alunite at Marysvale, employing about 200 men, thus culminating years of effort to have these resources exploited. Frank Eichelberger visited Tacoma, where he arranged for selection of a site for the aluminum plant, and he recently started preliminary work, leading to mining of the alunite and construction of an alumina plant in Utah.

▶ Magnetic separators have been installed by the Prosper Mining Co., of Milford at its mill erected to treat scheelite ore taken by power shovels from open cuts at the Hickory mine. The company expects to produce four to five tons of 50 percent tungsten concentrate each month, according to Edward Schoo, president. Ore is being mined from a lease in the Hickory shaft by Charles H. Segerstrom, Sonora, Calif., tungsten operator.

▶ Ore carrying gold, silver, lead, and copper is being mined by the Mountain Mines Co. in its Big Cottonwood property, 20 miles from Salt Lake City. Six feet of heavy sulphide is being followed in the objective vein struck in the main tunnel 3,165 ft. from the portal and 2,000 ft. below the surface. Leasers are shipping ore from the upper workings 1,300 ft. above the main tunnel. Values, according to Manager C. S. Woodward, range from $20 to $30 a ton.

▶ The Kentucky Utah Mining Co., also operating in the Big Cottonwood district, is following a streak of ore, carrying high silver-lead-copper values, in a drift leading toward the old Woodlawn shaft.

▶ Ore is being developed by the Mecca Mining Co. and the Western King Mines Co., holding leases in the Ophir Queen Mines property, Dry Canyon, Ophir district. Regular shipments are being made by the Mecca company.

▶ Ore carrying gold, silver, lead, copper, and zinc has been opened in the Jetteries and Henderson lease on the 1,100 level of the Bingham Metals mine, Carr Fork at Bingham.

▶ The New Cashin Mines, a Utah corporation with offices at Heber, plans to install a 100-ton flotation unit at the Cashin mine, in the La Sal mining district, western Montrose County, Colo., just over the State line from La Sal, Utah. Native silver and metallic copper are said to have been produced from sandstone. J. S. Bleazad, of Mountain Home, Utah, is president and George H. Ryan, of Salt Lake City, consulting engineer.

▶ On Oct. 22 Jesse Jones, Federal Loan Administrator, announced that the Defense Plant Corp. had authorized $35,000,000 for the construction of a plant for making pig iron, at Provo, Utah. Columbia Steel Co. will operate the plant, estimated to have an annual capacity of 725,000 tons.

IDAHO

Tungsten Ore Found In Grunter Gold Mine

If sufficient tonnage can be developed a recovery unit will be installed in plant of The Gold Producers Co.—Silver Dollar Mining Company starts deepening its shaft

▶ The Gold Producers Co. is mining and milling 150 tons of gold ore per day from the old Grunter mine, at Shoup, according to L. L. McLean, manager. The concentrates are hauled direct by truck to Salt Lake smelters. In addition to the large, low-grade gold ore deposit under operation, the company reports the recent discovery of a separate vein carrying high-grade scheelite, a tungsten ore. This discovery is now being investigated by geologists from the U. S. Bureau of Mines. If results are satisfactory, the Gold Producers Co. will install additional machinery for treatment of the tungsten ores. About 30 men are employed at present.

▶ Coeur d'Alene district mining companies which are interested in the C.I.O. labor demands affecting the local mining industry, including wages, two-week holidays with pay, and the closed shop, were informed this week that the national mediation board in Washington had turned thumbs down on the closed shop idea. The companies involved, Sunshine, Federal, and Day mines, are said to have granted the 50c. a day raise at the same time it was announced at the Bunker Hill and Hecla, but the C.I.O. union demanded $1 a day increase, and asked for two weeks' vacation with pay and a closed shop. The companies balked at these demands and carried the case to the national mediation board for final settlement.

▶ Butte and Coeur d'Alene Mining Co. has resumed operations on the Daisy property, east of Mullan, according to James E. Quinlan, manager in charge of operations.

▶ Callahan Consolidated Mining Co. has started a raise from the Red Monarch tunnel level to the old Rex workings, according to Joe Grismer, contractor in charge of the work.

▶ Governor Clark has appointed C. E. Arney, of Boise, as priority division mining coordinator of Idaho. The appointment is the result of a recent ruling of the OPM setting up regional offices.

▶ Idaho is the largest silver-producing State in the United States, according to the U. S. Bureau of Mines year book for 1940. Idaho's silver production for that year amounted to 17,552,240 oz., leading Montana, the second largest producer, by 5,191,190 oz. In all there were 362 producing mines in the State, but only 49 of them are listed as important silver producers with production averaging over 200,000 oz. The Sunshine mine, near Kellogg, is acknowledge by the mines bureau to be the largest silver-producing mine in the nation. Bunker

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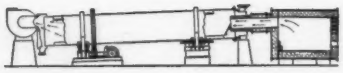

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▶IDAHO

Hill is in 8th place; Federal M. & S. company, 9th; Polaris, 11th; Hecla, 13th; Coeur d'Alene Mines, 15th, and the Sullivan Mining Co., 48th, or next to the last place. All of these mines are in the Coeur d'Alene district in Shoshone County. The Triumph mine, in the Idaho Warm Springs district, is listed in 17th place. Though Sunshine mine production declined 1,230,618 oz., increased production from other mines in the silver belt more than offset that loss.

MONTANA

Chrome Ore to Be Milled at Red Lodge

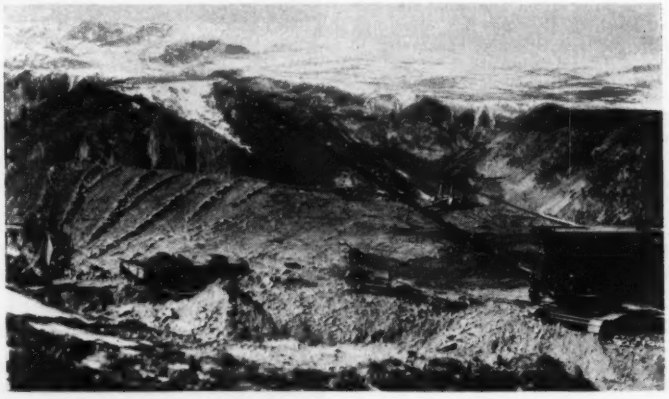
U. S. Vanadiaum Corporation is erecting a plant of 400 tons' daily capacity—Ore is mined by power shovel from surface workings

▶The Red Lodge unit of the United States Vanadiaum Corp. has started mining and hauling chrome ore to its new mill site at Red Lodge. Approximately 200 tons of ore per day is being mined in an open pit about 25 miles from, and stock piled near, the mill. Mill construction is under way with the expectation of starting operation in January 1942. Two power shovels are in use stripping overburden and loading the ore in 10-ton trucks. Road construction has started in the Hellroaring side of Rock Creek to exploit the chrome deposits in this area some time next spring. The mill is being enlarged to take an initial tonnage of 200 tons per day, with crushing and grinding capacity to handle 400 tons later.

The flowsheet at the Red Lodge mill will in general include, screening, tabling, and flotation. From the 150-ton mill ore bin ore will be fed to a Traylor gyratory crusher set to 1 in. Crushed ore is conveyed to a 300-ton fine-ore bin, from which it goes to a belt feeder to 20-mesh vibrating screens. Oversize from the screens goes to a 6 x 5 ft. Marcy ball mill, open-end type. Undersize from the screens is fed to classifiers. Sands from the classifiers are sent to tables, the concentrates from which will be loaded into railroad cars by a clamshell bucket. Slimes from the classifiers will be sent to a thickener and the thickened pulp sent to flotation.

L. K. Norton is superintendent of the Red Lodge unit, Jack George is pit foreman. Blair Burwell is general superintendent and W. G. Haldane assistant general superintendent.

Near the outskirts of the small community of Red Lodge, Carbon County, Mont., is this 400-ton plant being erected to treat chrome ore. Operations are expected to begin early in 1942



Two digging units, one a P. & H. power shovel and a Link-Belt dragline, are used to remove overburden and dig the chrome ore that is loaded into 10-ton trucks and hauled 25 miles, where it is stockpiled near the mill site

WASHINGTON

Grandview Mill Increasing Zinc Output

Capacity of plant enlarged to treat 14,000 tons of ore per month—Lead-zinc property in Ferry County to be developed

▶ Metaline Mining & Leasing Co. has made some changes in the Grandview mill to increase its capacity from 12,000 tons per month to more than 14,000 tons, according to D. I. Hayes, Western manager, American Zinc Lead & Smelting Co., 927 Old National Bank Bldg., Spokane, Wash. He reports that the mine of the Metaline Mining & Leasing Co. and the mine of Grandview Mines Co. are capable of supplying this additional tonnage. The ore from the two mines is treated in the Grandview mill.

▶ Silver Bell Mining Co., 13 miles northwest of Republic, is driving a tunnel which will pass under its large surface pit from which high-grade ore shipments were once made. William Delley, of Spokane, is superintendent.

▶ Royal Mines Co. is reopening the Big Chief mine, in Stevens County, and is hauling the ore to the Cardinal mill for concentration. The ore is said to carry 15 percent lead, 5 percent zinc, and 3 oz. of silver to the ton. The Cardinal mill is on the property of Ark Mines Co., on the Columbia River.

▶ A. A. Elmore has leased to Seattle and San Francisco mining men 2,000 acres of ground containing some deposits of magnesite in the Huckleberry Mountain district, of Stevens County. The leasers are said to have agreed to spend not less than $20,000 in drilling 40 holes to prospect the ground.

▶ United Copper Mines Co. has been formed to take over the old United Copper property at Chewelah, in Stevens County. This mine is said to have produced ore valued at approximately $1,500,000 more about 20 years ago.

ALASKA

Large Dam Completed at Livengood Placer

Water supply will be used for stripping overburden and thawing gravel—U. S. Bureau of Mines to examine nickel deposits—Chrome deposits on Kenai Peninsula being developed

▶ Livengood Placers has nearly completed its big dam across Hess Creek, in the Fairbanks district. The dam will impound water in the Hess Creek valley and divert it through a tunnel and ditch into the Livengood Creek area, where the water will be used for stripping and thawing the ground. The dam is 1,600 ft. long, 300 ft. wide at the base and 22 ft. wide at the crest. It will contain approximately 450,000 cubic yard of

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▶ALASKA

material, according to engineers in charge. The material used in the dam is sluiced into position from the hillside. Hydraulic nozzles force gravel into pipes from one side of the hill to the outer faces of the dam. From the other hill, muck and fine material are carried to the center of the fill, where they form a solidly packed core. Through the center of the dam is a wall of steel interlocked piling. When the sluicing becomes more difficult it may be necessary to use tractors and Carryalls to finish the top of the dam.

▶ Fifty thousand dollars will be spent this winter by the United States Bureau of Mines to explore nickel deposits on Yakobi Island, near Juneau, according to a report from the latter place.

Copper bailer used by early miners at Nome, Alaska, to bail water out of the sea into long toms and rockers. Several hundred of these rather impractical devices were made in Seattle about 1903-04 and used for two seasons. The bailer is made of heavy copper and has a handle socket. Photo and information courtesy of Ralph E. Mackay, Seattle, Wash.

▶ The Red Mountain Chrome Development Co., at Seldovia, is developing the Kenai Peninsula chromite deposits. One of the deposits is on Red Mountain and the other on Claim Point. A 15-mile road is being constructed along with a 5,000-ft. aerial tram, and camp construction is nearing completion. A wharf is being built at the lower tram terminal to load ships at tidewater, together with warehouses and quarters for truck drivers. F. L. Knouse, Seldovia, is in charge of operations.

▶ Jack Shields reports that during the summer he has tested and proven his ground on Six Mile Creek, in the Seward district. He is now ready to put in necessary equipment for mining. His property is the old placer ground of the Kenai Gold, Inc.

▶ B. D. Stewart, Territorial Commissioner of Mines, announces that the fourth assay office has been opened in the Territory by the Department of Mines. It is at Anchorage. The other assay offices are at Nome, Ketchikan, and College.

▶ J. C. Roehm, representing the Territorial Department of Mines, has spent a month in the Ketchikan district investigating deposits of such strategic minerals as tungsten, chromium, manganese, and antimony, besides zinc, lead, copper, and iron.

▶ Messrs. Draper and Crawford have taken an option on the claims of Belan and Emerson, on Ballarat Creek, in the Dawson district. Belan and Emerson, who have been working for several years on this creek, will continue to prospect and test the ground by sinking small shafts for the optionees.

▶ R. S. Potter, a mining man from eastern Canada, has acquired the Hiat Creek property, in the Mayo area, and has taken an option on several miles of placer ground where Elmer Middlejoff has been mining for 30 years. Mayukon Gold Placers, Ltd., has been employed by Potter to test his ground.

▶ It is announced that Treadwell-Yukon Corp. will not close its operations on Galena Hill, in the Mayo area, until Dec. 1. Large shipments of fuel and diesel oil have been sent in. Low water is reported on both the Yukon and Stewart rivers.

▶ Crabtree & Sullivan Mining Co. is making good progress in its operations on Eldorado Creek, near Bluff. With a new RD7 Carryall bulldozer gold-bearing gravel is picked up and hauled and dumped into a hopper and fed into the sluice box. This firm has carried on operations for 10 years, digging in an area near the Behring Sea, 60 to 70 ft. below sea level.

COLORADO

Portland Mine Connected With Carlton Tunnel

Remote-control switch sets off blast that unleashes water standing in mine for many years—Construction of vanadiaum plant at Rifle speeded

▶ A blast, touched off by means of a remote-control switch outside the portal of the Carlton Tunnel connected the winze level of the Portland mine with the tunnel and released a tremendous flow of water in the deep mine workings. An hour later a wall of water swept from the Carlton tunnel portal. The force of the flood washed out about 100 ft. of the fill which had been made around the mouth of the tunnel, sweeping a corrugated iron building, used as a blacksmith shop, over the brink. The 100,000 gpm. filled the tunnel to a depth of over 5 ft.; and in a few days the water, which had stood in the Portland mine for more than twelve years, dropped with a rush, draining the mine completely. Melford Salsbury, superintendent, states that no one is able to go below the 27th level until the shaft is repaired and the lower working put in workable condition, and this repair work is now in progress. The raise from the Carlton tunnel will be started as soon as the debris is completely cleared away.

▶ The U. S. Vanadium Co. rebuilding its plant at Rifle, has increased the number of men employed to speed up

the plant for production of vanadium. C. C. Sterns is superintendent. Vanadium ore is being delivered at the mill site at the rate of some seven hundred tons per month, one hundred tons having been received from the Meeker section, which is one of the oldest vanadium discoveries in the State. The Meeker ore is of high quality, and development is being encouraged by the U. S. Vanadium Co. Jenkenson and Hess & Son hold valuable claims in the territory and are shipping to the Rifle plant; and other ores received by the company are from Utah. Provision is being made to handle two twelve-hearth roasters with the possibility that an additional one may be installed. This will give the plant a capacity of 190 tons daily.

▶John Kolman, operating the Gold Empire Inc., at Cripple Creek, is making preparations for increased mining operations at the properties on Rosebud and Beacon hills, and Gold Run Gulch, which lies between them. The Henry Adney shaft is being reconditioned the full depth to the 700-foot level. A two-ton skip and a fourteen drill compressor have been installed. At the Mary Nevin, ore is shipped to the Golden Cycle mill. Larger hoisting facilities are being installed on the property.

▶The Empire Zinc Co., at Gilman, is shipping about 600 tons of ore daily that averages more than 10 percent zinc to its mill, which is in addition to the large body of silver-copper-lead ore that is being mined and shipped to Utah smelters. R. C. Jones is superintendent.

▶The Rico Argentine Mining Co. has purchased some 200 claims from the Pelleyre Mining & Milling Co., which property was jointly owned by the Pelleyre and the International Smelting & Refining Co. The deal includes all of the various mines on Newman Hill, runs under the Rico townsite, and ties in with extensive holdings on the mountains west of the river. The Shamrock, Propatria, and Atlantic Cable mines, prominent among the group, contain lead, zinc, and copper, with silver and gold. The Propatria is being put in condition for operating, and snow sheds are being constructed to provide for winter work.

▶Silver ore, reported to carry 200 oz. per ton, has been encountered in level No. 1 of the Highland Mary mine, in Cunningham Gulch, Silverton. The property has a 100-ton mill. Vein widths up to 8 ft. are reported, and the new orebody is now being developed. Silver is found in gray copper; and this productive section of the Highland Mary mine was opened by J. M. Bradley, general manager.

▶An aerial tramway is now under construction at the Last Chance mine, at Twin Lakes, by Smith Bullard Mines, Inc., with Howard Bullard president. Development work is started under the supervision of John G. Green.

▶Lode and placer operators in Park County will mine a record output of gold this year. The South Platte dredge will add greatly to the production. This era of operation was started when S. J. Gately persuaded the late W. K. Jewett, principa stockholder in

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▶COLORADO

the London Mines & Milling Co., to build a mill for the low-grade ore of the London Mines. This property is now under the management of H. L. Tedrow. Since mill construction in 1933, operations have been continuous, and today some 250 tons are mined and milled daily. The tailings disposal problem was solved by Superintendent Tedrow, by a scheme which permits of building the pond in the spring, summer, and fall, and then using the pond for winter disposal of tailings. The ore is a quartz gangue containing gold, silver, pyrite, and galena from the London fault zone. An innovation is the installation of electric elevators in the mine, controlled by pushbottons.

▶ The Mendota mine, in the Georgetown area, financed by Chicago capital, is being unwatered with new pumping equipment. The management expects to work the Frostberg vein, cut by the 1,700 ft. tunnel, and the old workings of the fourth and fifth levels.

▶ Gold, Silver, Tungsten, Inc. has resumed work at its Forest Home mine, which was a producer of tungsten ore during the last World War, Mine rehabilitation is under way to mine a large body of low-grade tungsten ore. The mill is now running on a two-shift basis and treating mostly ore from the Black Rover group on the Beaver.

▶ The old plant of the International Smelting & Refining Co. at Rico is being dismantled under the direction of F. E. Dean, and the machinery is destined for Salt Lake City, Utah, and to Battle Mountain, Nev., where the company is preparing for producing copper from the Copper Canyon property.

▶ The London Butte Gold Mines Co., under the directeon of George F. Schreiber, has been operating steadily for several years. This property is on the opposite side of Mosquito Creek from the London Gold Mines. In contrast to the London mine, the London Butte ore is all hoisted. The ore contains gold, silver galena, and chalcopyrite in a porphyritic gangue, and is extracted also from the London fault zone. The mill a gravity type, treats about 80 tons daily. The ore has been pockety and mining in some instances has been more difficult.

▶ A road is to be constructed to the Ruby tungsten mine, in Maggie Gulch, Silverton, so that compressors and other machinery can be delivered. R. E. Margenau, consulting engineer, is now laying out plans for development of the property. R. B. Moyle is in charge of operations, and has made several shipments of tungsten ore.

▶ A compressor and other machinery have been installed at the Tom Moore tunnel of the Habita Gold Mining Co., Cripple Creek. As soon as power lines are completed, development work will be under way. First attention will be given the vein showing tungsten.

▶ The Coal Creek area of Rio Blanco County is the scene of renewed mining for vanadium. The claims owned by James Riland are being worked, and shipments are made regularly to Denver and also to the U. S. Vanadium Co. mill at Uravan, Colo.

▶ The principal mine in the Gunnison County district is the Carter mine, at Ohio City, which has operated continuously for more than 20 years. The main tunnel is two miles long; and at its end there is a four-compartment raise, making unexcelled ventilation and drainage possible.

MICHIGAN

Three Copper Producers Aided by OPA

Contracts covering sales of output at a price above the 12c., Valley, basis are completed and signed

▶ Commenting on published reports that agreements have been concluded between the Procurement Division of the Treasury Department and three high-cost Michigan copper producers for the purchase of their output for a limited period at higher-than-ceiling prices, Leon Henderson, administrator, Office of Price Administration, issued the following statement on Oct. 21. "On Aug. 6, 1941, the Office of Price Administration announced that a ceiling price of 12c. per pound would be established shortly for copper. It was also stated that a method designed to insure continued production by mines having high costs had been developed. Under this proposal, it was recommended that the production of those companies whose 'out-of-pocket costs' were in excess of 11c. per pound in the first six months of 1941 should be purchased by the Government at a price 1c. a pound above such costs. The plan would only be open to qualified domestic producers already operating. With the full knowledge of my office, Copper Range Co., Isle Royale Copper Co., and Quincy Mining Co., three of the so-called 'high-cost' Michigan producers, subsequently entered into negotiations with the Procurement Division of the Treasury Department looking toward the sale of their output under the OPA formula. In the case of these three companies, this formula was adjusted on recommendation of the Labor Division of OPM to allow an increase of $1 a day in wages, which had been abnormally low. It is my understanding that contracts covering sale of the production of the three companies for a limited period are nearing completion. Obviously, whatever prices may be involved in these agreements are above the 12c. ceiling set by OPA. These contracts, being arrived at pursuant to the OPA formula, have the full approval of my office." Since this statement contracts were signed early in November by three Michigan producers and the Procurement Division of the Treasury Department.

▶ The mining companies of Houghton County employed 3,065 men, underground and on surface, during the past fiscal year ended Sept. 30, according to the mine inspector's annual report filed with the county board of supervisors. There were 1,298 men in underground

employment and 1,767 on surface and in the mills. Six fatalities occurred in the mining industry in the county during the year, as compared with three for the previous year.

▶ Steps have been taken by the Calumet & Hecla Consolidated Copper Co. for the dissolution of the Ishpeming Gold Mining Co. by transfer of the stock on a share-for-share basis for Calumet & Hecla stock. No official statement has been made as to purpose of this action. The Ishpeming company holds the lease to the old Ropes gold mine, about four miles north of Ishpeming. In 1927 Frank Lundin and Albert Bjork, of Ishpeming, acquired control, through lease, of a tract of land north of that city, it including the site of the Ropes. In 1932 they organized the Ishpeming Gold Mining Co. Some stock was taken at that time by C. & H, this later being extended to a majority interest.

TRI-STATE

Boost in Zinc Price Brings Higher Wages

Operators believe margin of necessary mine exploration and development limited, however, under the new price—St. Joseph Lead Co., moves to 6-day week at Bonne Terre

▶ An advance of $6.70 a ton in the price of zinc concentrates, from $48.58 to $55.28, during the second week of October to the highest level since January, 1926, featured the news of the Tri-State last month. Several leading ore producers, though gratified at the increase, said it would just about take care of the increasingly higher cost of supplies used in mining and the wage increase for miners that accompanied the price increase automatically. In keeping with a customary sliding scale of wages to that of the zinc ore price, wages of Tri-State mine and mill employes were increased 75c. a day generally throughout the mining field. Base pay of machine men was increased from $5.55 to $6.30 a day. With some 6,000 employes, payrolls of mining companies operating in the district were augmented by an estimated $30,000 weekly. It was pointed out that the higher price will help sustain the present rate of production for a time, but a still higher price will be needed to encourage further exploration and new development work that are so badly needed to maintain and increase output for the long pull. Uncertainty of the labor situation in the field was relieved considerably by the advance, although the pay under the new price is still less than competitive with the wages being paid in large government defense projects in this region. After more than a year of the same slab zinc quotation, the increase in the ore price occurred with the announcement by Price Administrator Leon Henderson on Oct. 9, that a new maximum price schedule on slab zinc would boost the metal from 7.25 to 8.25c. a pound, East St. Louis.

▶ The St. Joseph Lead Co. announced recently that production at its properties

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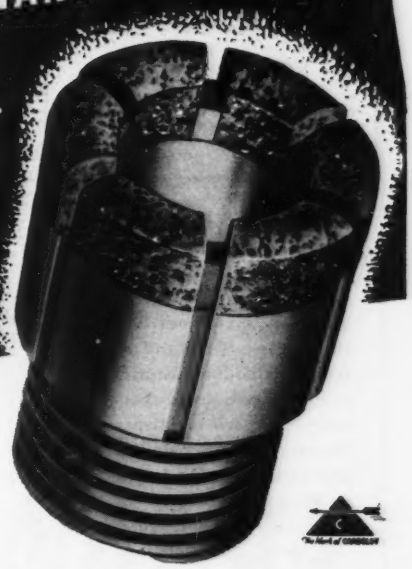

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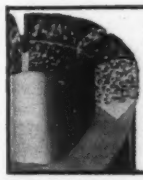

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▶TRI-STATE

in Missouri will be increased about 15 percent beginning Oct. 25. To bring about an increase in output of around 1,700 tons a month, the work-week will be extended to six days and the company will pay time and one-half for overtime.

▶ Twenty-four weeks to the day after the flooding of district mines last spring, torrential rains the first few days of the month caused the flooding of several mine properties again. Among the properties flooded were the Romo, Craig, Oklahoma Interstate, Woodchuck, Eagle-Picher Jay Bird, Stanley and Hum-bah-wat-tah No. 1; Mahutska-Acme, Skelton, Admiralty, Rialto No. 3, Roan Bull, Federal Jarrett, Beck, M. & W., Youngman and several other mines in the Picher field; the Capital and Stotts City mines at Stotts City, the Wentworth mines near Wentworth, the old Dividend mine at Spurgeon, and the Hopi Crane mine near Thoms Station. Practically all the properties resumed operations during the second week of October, with the exception of the Romo, Craig, Capital and Stotts City, the Dividend and the Hopi Crane. Although mines at Oronogo and those of the Lula Bell Mining Co. on the Opperman lease, southwest of Baxter Springs, were threatened by flood waters, they escaped any serious stoppage of operation schedules. These latter properties were damaged severely by floods last spring. Water rose 20 feet in the mines being dewatered by Fred Childress & Sons in the old Galena mining area, but the Bailey shaft on the Southside tract was pumped out during the following week. As a result of the floods, zinc concentrate production for the month was reduced about 2,000 tons.

▶ A rich lead mine is being worked by the Lucky Cycle Mining Co. on the Brugger land, a mile northwest of Baxter Springs. The mine is situated in virgin ground west of the old Brugger workings on the east part of the original 160-acre tract. More than 1,500 tons of the rich ore has been stockpiled on the surface. Various assays taken from the stockpile while it was being hoisted range from 5 to as high as 21 per cent in recovery of galena, according to Dr. C. W. McCarthy, president of the company. Associated with Dr. McCarthy are Earl Keeton of Joplin, Clint Nunn, mine superintendent, and Dr. C. I. Trimble and George Reed, both of Tulsa.

▶ Mission Mining and Royalty Co. has completed the rebuilding of a new derrick and 150-ton hopper over its mine shaft on the Waxahachie lease, two miles east of Quapaw, according to Jack Howard of Baxter Springs, company superintendent. The property and equipment, which was destroyed by fire a few months ago, has been sub-leased to James Osborne of near Quapaw. The mine is producing about 100 tons of ore rock daily, which is averaging about 7 per cent in blende recovery values and is being treated over the Mission mill.

▶ F. W. Evans of Picher has started pumping operations for the dewatering of the Sucker Flat mining basin in the south-central part of Webb City, preparatory to the resumption of mine operations. A six-inch Pomona turbine pump was installed in a shaft bordering Sucker Flat on the west, which was put down to a depth of 140 feet about two years ago. When the shaft is dewatered, it will be continued down to the 200-foot level, where ore will be pulled from the old Sucker Flat workings.

Old Mine in New Jersey Being Prospected

▶ Near Andover, Sussex County, N. J., about 12 miles southwest of Franklin, are remains of several open cuts from which a good tonnage of iron ore was reported shipped many years ago. Recent prospecting and preliminary sampling have revealed that ore at the old Andover mine contains a fair amount of zinc. Howard A. Hewitt, of Lafayette, Sussex County, has started shaft sinking on this property, where he has mining rights covering 657 acres. Equipment consists of an Ingersoll-Rand compressor, several rock drills, Timken removable bits, and other mining supplies.

IRON COUNTRY

Shipments Delayed by Fall of Bridge

Delivery of iron ore behind schedule due to collapse of International span over Soo Canal—Large manganese concentrator to be built at Crosby

▶ A serious delay in shipping was caused on Oct. 7, when one arm of the International bridge at Sault Ste. Marie, Mich., just above the locks, collapsed, cutting off traffic through the two largest locks. Shipping was completely stopped for 48 hours by this catastrophe, as only the Canadian lock and one small American lock were available. How much tonnage was lost by this delay is not known, but estimates run as high as 500,000 tons. Despite this delay, estimates for the season's shipments are still set at better than 79,000,000 tons, depending of course, on weather conditions on the range during October and November. The ice crusher "Sainte Marie," owned by the Mackinac Transportation Co., has been chartered by the government to extend ore shipping through St. Marys River.

Mesabi Range

▶ Oliver Iron Mining Co. is starting construction of a pilot mill for further study on concentrating certain ores on the Mesabi range, principally those on the western end of the range. The mill will be located at the Trout Lake Plant, Coleraine, Minn. It will be of 10-ton per hour capacity and will consist of all types of concentrating methods. However, the initial installation will be for jigging processes only.

▶ A threatened strike by the C.I.O. at the Cleveland-Cliffs Iron Co. mines on the Mesabi range was stopped by a three-man commission appointed by Governor Stassen of Minnesota on the grounds that the labor union did not show a majority of the workmen involved were members of the C.I.O.

Cuyuna Range

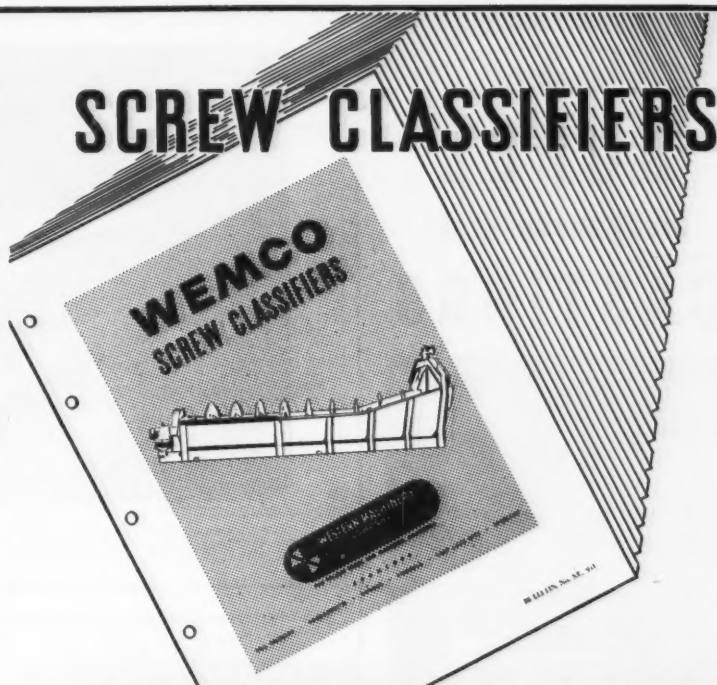
▶ The Office of Production Management has just approved a proposal for the construction of a $5,000,000 manganese concentrating plant at Crosby, Minn., on the Cuyuna range. The plant would have an annual capacity of 100,000 tons and might possibly be in operation within a year.

Marquette Range

▶ The Cleveland-Cliffs Iron Co. announced in the middle of October that it will reopen its Princeton mine, in the Gwinn district.

▶ A drilling program was recently started by the E. J. Longyear Co., for the Republic Steel Corp., on the Foxdale property, at Humbolt, in the western part of the range.

SCREW CLASSIFIERS



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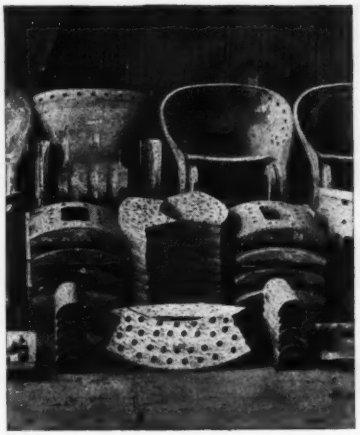

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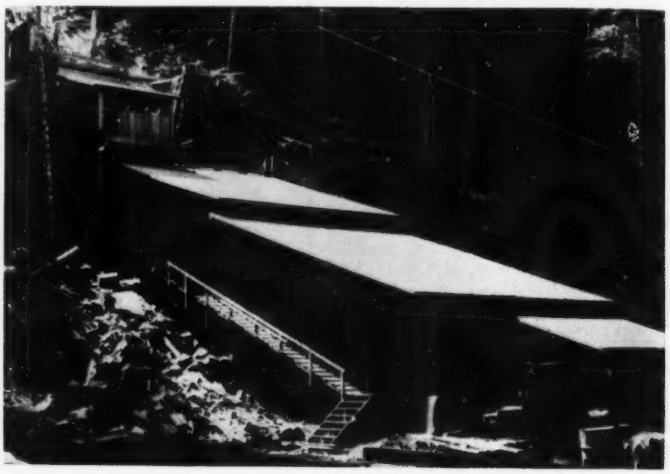

The 25-ton plant of Buccaneer Mines, Ltd., Bidwell River, Vancouver Island, is one of the latest mills to start operations among British Columbia gold producers

CANADA

Government Moves to Freeze Wages and Commodity Prices

Mining industry views measure as promise of stability—Steep Rock Iron Mines plan to resume drilling program—C.I.M.M. has Division meeting in Vancouver

▶ With the announcement by Prime Minister Mackenzie King of a program of sweeping government control over prices and wages to go into effect on Nov. 17, the Canadian mining industry finds promise of a greater measure of stability in costs and wages than has so far been possible under war conditions. Gold producers are no longer in fear of inflation. This new legislation is accepted generally as the most constructive step yet to be taken in the Dominion's war effort. Several factors will affect the earnings position of mining companies. By freezing the base wage, operating costs will tend to be uniform. Although cost-of-living bonuses must be added to the base wage, an increase in living costs should be controlled by a ceiling for commodity prices. Official action is expected to maintain a low profit margin for industries working on war contracts. Profits will continue to be threatened by the possibility of higher taxes, although many mine operators now insist that the economic limit of taxation schedules has already been reached.

QUEBEC

▶ Labor unrest in Kirkland Lake, which may spread to Porcupine and other mining camps in the East, now appears to be centered on the demand for union recognition. The Board of Conciliation was forced to end its hearings on Oct. 6 when the twelve mine operators represented refused to present case, on the grounds that the C.I.O. union was not responsible as a bargaining agency. Later the three members of the Board submitted a unanimous report recommending recognition of the union. An attempt is being made by the Minister of Labor at Ottawa to call a meeting between mine and union officials. Since the operators have taken a determined stand against such procedure, the local union may petition the Department of Labor to take a strike vote.

▶ The Dominion Bureau of Statistics has issued final figures for Canada's 1940 mineral output. The total value of $529,825,035 exceeds the previous record made in 1939 by 12 percent. Gold production set a new record of $204,479,083. Copper, nickel, lead, and zinc had a combined value of $155,922,881. The total output of metals was worth $382,503,012. Coal, natural gas, crude oil and other fuels amounted to $78,837,874 and other nonmetallics were valued at $26,011,498. Structural materials totaled $42,472,651.

▶ High prices for coal in central Canada and a threatened shortage due to transportation and exchange difficulties between Canada and the United States have led to some active exploitation of peat bogs, of which Canada has an estimated 113,513,000 tons. The 107 peat bogs cover an area of 37,000 square miles, second only to the resources of this fuel in Russia. Ontario's 41 deposits are capable of producing 26,500,000 tons, located within shipping distance of Toronto. Svend Thomsen, manager of a large bog in Dufferin County, has installed a new type of peat removal machine to meet increased demands.

▶ The Moss mine, near Ottawa, is producing molybdenite for the first time since 1918. Controlled by the Quyon Molybdenite Co., milling operations have been in progress for three months. The daily average of 175 tons of ore is reduced to about six tons of 90 percent concentrates a week. The product is being used in Canadian steel plants.

ONTARIO

▶ It is reported by F. S. Base, secretary-treasurer of Missinaibi Clays & Mining, that transportation problems have been worked out for the first shipments of Kaolin, refractory clay, and silica sand. The property is near James Bay, in northern Ontario, 14 miles over muskeg from the railhead at Smoky Falls. Bushmaster wagons equipped with wide pneumatic tires will be used for year-round hauling. In Newfoundland a similar haulage program established costs at 2½c. per ton-mile. Freight rates to points in southern Ontario amount to about 1c. per ton-mile. John C. Rogers, consulting engineer of Toronto, is one of the directors of this pioneer project.

▶ After blocking out hundreds of millions of tons of good-grade ore, Steep Rock Iron Mines now plans to resume its extensive drilling campaign for the purpose of defining boundaries of the orebodies, in line with plans for underground development. Diamond drilling will also be undertaken from the ice this winter to determine how much detritus must be removed from the bed of Steep Rock Lake. With the recent entrance of strong American steel interests into the picture, financing arrangements for the ambitious undertaking are expected to be made as soon as estimates on costs have been completed. Power requirements for dewatering the lake may be greater than original calculations, since the lake level is now 12 ft. above normal. Joseph Errington is president and Eldon L. Brown consulting engineer.

▶ The main operating No. 7 shaft at Lamaque Gold Mines is being deepened to 3,600 ft., with the lowest station to date being opened at 3,200 ft. Above this a block of new levels is undergoing development. Ore reserves now approach 1,000,000 tons for a milling capacity of 1,200 tons daily. Above the 2,400-ft. horizon in the main shaft stations have been cut at intervals of 600 ft. and a subsidiary incline opening used for opening levels 100 ft. apart. The second shaft is not to be carried lower than that point and all stations will be opened from the No. 7 shaft. Stoping has not yet been carried below the 1,400 level. Development of the six levels from 1,800 to 2,400 ft. is advanced to only about 50 percent. On the upper levels ore lengths have averaged about 2,500 ft. per level. H. N. Read is general superintendent and John C. Perry mine superintendent.

▶ Pascalis Gold Mines, adjoining the Perron mine on the east, is exploring a promising section of granodiorite close to the boundary by means of a series of drill holes from the 1,500-ft. level of the Perron. Good values have been intersected at a point 300 ft. inside the Perron line. Anglo-Huronian, Ltd., participated in financing shaft sinking to 1,500 ft. Crosscuts were driven on the four bottom levels of the shaft, which is 900 ft. from the Perron boundary, and all headings have approached the favorable section of granodiorite. E. V. Neelands is consulting engineer.

▶ Recovery at Stadacona Rouyn Mines is averaging $5.05 a ton, according to a statement by George Duclos, permanent

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▶CANADA

liquidator. In the first half of the year production amounted to $403,210 and has since been substantially improved. The development program is being extended. An accurate list of stockholders is now being prepared to allow a fuller control of outstanding stock at such time as a reorganization takes place. The liquidator proposes to have the status of Stadacona notes established this fall by the courts. Horace C. Young is mine manager.

BRITISH COLUMBIA

▶ During the three days Oct. 8 to 10 inclusive, a large and representative gathering of mining operators and technical men, including a number of persons prominent in the industry throughout Canada, met at Vancouver for the 21st annual meeting of the British Columbia Division of the Canadian Institute of Mining and Metallurgy. Papers presented were as follows: "The Sheep Creek Gold Mining Camp," by R. A. McGuire; "Geology of the Ore Deposits, Musketeer-Buccaneer Area, Bedwell (Bear) River, V. I.," by Franc Joubin; "The Monarch Mine," by J. D. Galloway; "The World Oil Situation," by Max W. Ball; "The Oil Situation in Western Canada," by J. S. Irwin; "Oil Possibilities in Northeastern B. C.," by M. Y. Williams; "Hydro-Electric Development in B. C. and Possibilities of Future Development," by Ernest Davis; "The Development, Construction, and Equipment of the South Main Shaft at Flin Flon," by J. P. Caulfield and E. Backman; "Block Caving at the Johnson's Company Mine, Thetford Mines, P. Q.," by the staff; "The Size and Mineralogical Distribution of Gold Particles in a Flotation Tailing Sample, Britannia, B. C.," by H. V. Warren and C. Ney; "Emanations over Oil Fields and Ore Deposits and Geochemical Possibilities in Canada," by Hans Lundberg; "Recovery of Tin from Sullivan Tailings," by H. R. Banks; and "Research and the Mining Industry," by F. A. Forward. Addresses were delivered by Professor W. G. McBride, president of the Institute; E. M. Little, director of War-Time Bureau of Technical Personnel, T. A. Rickard, G. C. Monture, associated with George C. Bateman, Metals Controller; and J. W. Spangler, vice-president of the Seattle First National Bank.

▶ North American Goldfields, Ltd., conducting a floating dragline gold-dredging operation on the upper Fraser River at Alexandria Ferry, has had a successful season in the first venture of its kind ever attempted in British Columbia. The operation of this company was undertaken directly as a result of the action of the Dominion Government in removing the customs duty on dredging equipment. A 2¼-cu.yd. Lima Dragline dredge, powered with a 260-h.p. diesel engine, operates a 2¼-cu.yd. Page bucket on a 60-ft. boom. All parts and equipment for the washing plant were obtained in the Province. Although the plant has a capacity of 4,000 cu.yd. daily, only 3,000 cu.yd. daily have been mined, owing to the necessity of using the dragline shovel for stripping operations part of the time. The area being dredged is one of the many flats along the Fraser River which lie about 20 ft. above the water and have from 2 to 6 ft. of silt superimposed on the gravel. This gravel is practically free from boulders and is ideal for easy digging. The gold, in most cases, is fine and lies in the upper 10 ft. of gravel. The company dredges the upper 8 to 10 ft., which represents the most valuable portion of the deposit, with recoveries ranging from 20c. to 35c. per cubic yard under average conditions. Costs have been kept consistently under 15c. per cubic yard. The company has announced its intention of operating a second dredge in the Cariboo district in 1942, and several other California operators are expected to commence operation on ground tested this year. Glenville A. Collins is managing director of North American Goldfield, Ltd., with office at 208 Pemberton Bldg., Vancouver, B. C.

▶ The presence of scheelite is being investigated at the Stump Lake property of Consolidated Nicola Goldfields, Ltd. Though showings are numerous in the King William vein, with particular quantity towards the southern extension, no values have been found to date in the Enterprise vein, the other productive gold-bearing lode. The discovery has attracted the attention of government authorities and has been inspected by Colin Campbell, of London, England, representing the British Government, and by Dr. W. E. Cockfield, of the Dominion Department of Mines and Resources.

MEXICO

Strike at Several Penoles Mining Units Settled

New labor contract signed Oct. 20—Hope is held for improved general economic conditions as United States and Mexico approach settlement of problems

▶ Labor difficulties in effect since Sept. 8 at mining and metallurgical units of the Cia. Minera de Penoles, a subsidiary of the American Metal Co., were ended when a labor contract was signed on Oct. 20. Operations at the company's lead refinery in Monterrey are expected to be under way soon.

▶ Mining in Mexico showed some improvement, mostly spiritual, in mid-fall because of high hopes that markets and general conditions will be better as a result of the expected settlement of several matters that have been long pending between the Mexico City and Washington governments and the big cash accommodation of some sort, loan or credit, that the American government is reported to be ready to make this country. These hopes have prompted some developments in the industry. Mexico City stock exchange and financial circles are talking about a looked-for assured purchasing of at least 5,000,000 oz. of silver a month at a price that,

these sources opine, will be about 4c. an ounce higher than the current rate, by the American government from Mexico. This big business is counted upon to stimulate not only the silver branch of the business but that of other metals and minerals the mining of which is allied with silver.

▶ There is much speculation as to how foreign exchange, a vital factor for Mexico mining which depends largely upon exports, will go should the American money accommodation be forthcoming. Some say the dollar will remain as is, 4.86 pesos; others that it will go to 5 with the removal of the 12 percent extra tax on exports, or drop to 4.50, with this impost remaining.

▶ Road construction has helped and will aid mining in several regions of Mexico. Opening of several sections of the southern Mexico division of the Pan American Highway, the road between Mexico City and Suchiate, on the Guatemalan border, has made possible completion of arrangements for exploitation of important manganese, gold, and silver deposits in the Caujilote district, Puebla. This zone is also being served by new State roads.

▶ President Manuel Avila Camacho has ordered a federal expenditure of 3,000,000 pesos ($615,000) for construction of a 200-kw. long road between Ensenada and San Quintin, Baja California, to serve gold, silver, and other important mineral and metal workings along the Pacific Coast of that Territory. Federal money is also to be provided for the building of a road that will directly connect the northern and southern districts of Baja California.

▶ Payment of 5,347 pesos ($1,090) has been made by Cia. Minera de San Carlos, S.A., San Carlos, Chihuahua, to Sra. Concepcion A. de George as compensation for the death of Newton George, her husband, an American employee, in a recent accident in one of the company's mines.

▶ Credito Minero y Mercantil, S.A., Mexico's pioneer mining financing bank, has established in Mexico City a subsidiary, the Banco Industrial, S.A., to expand its business. Raul Bailleres is president of both banks. Lic. Carlos Novoa, former manager of the Association of Bankers of Mexico, is general manager of Industrial, which began business with a capital of 5,000,000 pesos ($1,100,000), and Eduardo Villaseñor, managing director of the Bank of Mexico, is one of its directors.

▶ Financiera Minera, S.A., a mining financing and mining products trading bank, has opened in Mexico City with a capital of 1,000,000 pesos.

▶ A senatorial committee is investigating the petition of several important mining companies that the federal labor law be changed to bar as employment candidates all persons suffering from silicosis. The companies say that these people are unfit for underground mining work as that employment before long incapacitates them for service and as the law now stands obligates the employers to compensate them because they are regarded as victims of professional diseases, illnesses contracted while employed.

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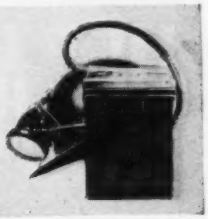

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SOUTH AMERICA

More Copper Bought By Metals Reserve

Shipments during remainder of year will total around 96,000 tons—Copper mining companies receive special priority assistance on equipment and supplies from the United States

CHILE

▶ Jesse Jones announced in October that Metals Reserve has purchased an additional 96,000 tons of Latin American copper at 11¼c. per pound, f.a.s. New York, for November and December shipment. Subsidiary companies of the Anaconda Copper Mining Company in Chile will furnish 62,000 tons, and Kennecott Copper, 34,000 tons.

▶ In a New York speech, on Oct. 14, Donald M. Nelson, executive director SPAB, announced special priority assistance under Preference Order P-58 granting A-3 rating to four major South American copper-mining companies in obtaining equipment and supplies to speed production. He also revealed that copper available for October allocation totals 139,000 tons, and that demands with "A" rating total 145,000 tons.

▶ Exports of kieselguhr or diatomaceous earth totaled 202 metric tons in the first seven months of 1941, against 256 tons in the same period last year, according to the Department of Commerce. Argentine took 150 tons, Brazil 51, and Uruguay 1 ton of the 1941 shipments.

BRAZIL

▶ During the first eight months of this year Brazil has shipped through the port of Rio de Janeiro 231,043 long tons of manganese ore. Of this total Cia Meridional de Mineracao shipped 121,125 tons, A. Thun & Co., Ltd., 51,115 tons, Mineracao Geral do Brasil, Ltd., 24,400 tons, Seligmann & Co., 7,400 tons, Castro Lopes & Tebyrica, 7,080 tons, and eight other shippers the remainder in lots of less than 5,000 tons each, according to the Department of Commerce.

▶ A company known as Magnesite, S.A., was organized several months ago to exploit two magnesite deposits reported found in southern Bahia. The ore of one deposit is said to be of refractory grade; that of the other is suitable for manufacture of magnesium metal. Ore reserves of each deposit are estimated at about 40,000,000 tons. The company expects to produce and burn magnesite on a small scale for the Brazilian industries needing refractory materials. The Bank of Minas Geraes is said to have financed this rather small activity.

COLOMBIA

▶ Production of gold totaled 59,200 oz. in July, a gain of 8,422 over that of June. August output is expected to show little change, despite the reported shortages of zinc, mercury, and cyanide for the gold-mining industry.

AFRICA

Some Relief Afforded From Excessive Taxation

Enacted measure, however, is more severe than many companies expected—Efforts under way to reduce mining costs as price of mining supplies increase

▶ The British Government's long-awaited legislation for the relief from excessive taxation of oil and mining companies which have expanded their production in an effort to supply warring requirements has now been published. It falls

far short of producer's expectations. In considering its effects it is necessary to keep in mind the fact that oil and metal producers are required to pay 100 percent excess-profits tax on all profits in excess of the best of those made in the years immediately preceding the outbreak of war. Recognizing that such taxation appropriates the whole of the net value of such greater amount of oil and minerals as may be produced, the new law will permit companies having a short productive life to retain a small portion of the profits realized on the excessive amount of output. If a company can convince the Treasury that its ore or oil will be exhausted within the periods mentioned below, it will be allowed to retain, of the 100 percent hitherto levied.

	Per Cent
1946–1950 inclusive	30
1951–1960 inclusive	20
1961–1970 inclusive	10
1971–1990 inclusive	5

Such concessions apply only to such profits as are realized on the excess of production. The matter of wasting assets in general is not considered. Each producer must have his claims considered separately and must hold a Treasury certificate. Opinion is that it will be difficult to convince the Treasury that a mine is producing more than it would have been except for the war, that its resources will be exhausted within a given time, that its product is essential to the war effort, and to answer, and prove its answers, to many other questions which may be put. It may be questioned whether developed ore is to be taken as the measure of resources. If so, those companies which have developed their mines far in advance, and those which have proved ore many years ahead by drilling, will in effect by penalized for having done so. However, there is a general disposition to share profits liberally with the government while the war continues, and a general indisposition to claim anything more than plain necessity and justice demand. No important controversy is likely to develop.

▶ It is known that the attention of mine managements on the Rand is directed chiefly to an effort to reduce costs as rapidly as operating expenses increase due to the rising prices of supplies. A further advance of mine wages seems imminent.

▶ The sensationally rich developments in the Blyvooruitvich property are said to be continuing, but it will be some time before another official report is issued. There is great interest in every scrap of information coming to hand, and even rumors are increasing the enthusiasm in the several West Witwatersrand companies.

▶ Spaarwater Gold Mining, in the Far Eastern Witwatersrand, has discontinued mining operations for the purpose of conserving financial resources. The property is on a care-taking basis, but pumping is continuing. Development in this property, largely carried out by Sub Nigel, has revealed some excellent ore, but the width of the veins is disappointing, being only 7.8 in. to 14.5 in., except in one case where the reef channel was 19.3 in. wide. Values, which range from 10 dwt. to 30 dwt. in these narrow channels, appear to be somewhat patchy.

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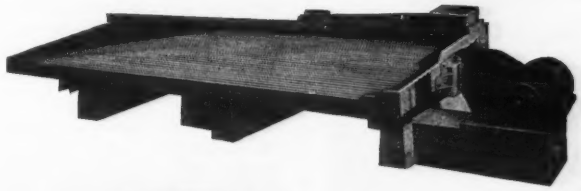

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AUSTRALIA

Bauxite and Copper Deposits Being Investigated

Committee appointed by Commonwealth Government will direct the work—Bauxite ore reserves in New South Wales total 10,000,000 tons

▶The importance of producing aluminium from Australian bauxite has led to the formation by the Commonwealth Government of a committee to investigate the bauxite resources of the country as well as to inquire into the possibilities for increasing the output of copper. The committee comprises Sir Colin Fraser (director of material supply, Ministry of Munitions), Dr. H. G. Raggatt (Commonwealth geological adviser), Mr. A. J. Keast (superintendent Zinc Corporation, Ltd.), Messrs. J. M. Newman and J. Horsborough (director and general manager respectively of Tableland Tin Dredging N. L.), and M. J. Martin (Sulphates Pty., Ltd.). The committee is investigating the possibility of reopening certain old copper mines and the availability of bauxite to meet the requirements of defense and the general needs of the population. A report recently issued places the reserves of bauxite ore immediately available in New South Wales at 10,000,000 tons. The principal bauxite deposits in that State are in the Emmaville and Inverell districts in the north, and at Wingello, in the southern mountains. The latter occurrence contains from 29 to 61 percent of alumina and 2 to 30 percent iron, with 3 to 9 percent silica. Deposits in the Emmaville area contain from 27 to 49 percent alumina, 13 to 29 percent ferric oxide, and from 0.16 to 13 percent silica. It is frequently roughly stratified and is found capping small hills, in many cases surrounding points of eruption of the Tertiary basalt. In Western Australia, the Darling Ranges east of Perth have extensive occurrences which have only lately been investigated, and which are easily accessible to railways. Ninety miles northeast of Perth, at Wongan Hills, are other large deposits which are reported to contain approximately 44 percent of alumina. At Greenbushes, in the south of the State, extensive areas of lower-grade bauxite exist. The largest bauxite occurrence in Victoria is at Boolarra, in Gippsland, east from Melbourne, and has been worked for some years for the production of sulphate of alumina. As it is close to the Yallourn power station of the Victorian Electricity Commission, the deposit may be closely examined to define the tonnage of ore of suitable grade for smelting. The Queensland Government is examining occurrences of considerable size at Tambourine Mountain, and it is reported that interests have been secured by a large company which is in course of formation. Alunite, which may now be turned to greater account than in the past, occurs at Bulladelah, in New South Wales and has been worked intermittently for a period of about 40 years.

NEW SOUTH WALES

▶The Broken Hill Proprietary Co., Ltd., for the year ended May 31, 1941, earned a profit of £A960,279, compared with £A979,138 in 1940, and £A1,431,513 in the preceding year. The profit was determined after providing £A996,881 for depreciation, £A1,050,000 for taxation (an increase of £400,000 on the previous year), and £A456,330 for special depreciation connected with wartime activities. From being the pioneer mining company on the Broken Hill line of lode in 1883, the company has, through its establishment of the iron and steel industry, which is utilizing the iron ore deposits previously used as flux in the company's lead smelters, become the largest industrial undertaking in Australia. It might, in fact, be termed the backbone of the Commonwealth, for there is little doubt that the country owes more to its enterprise and sound administration than to any other industrial organization. From the iron ore deposits at Iron Knob have grown the iron and steel works at Newcastle, New South Wales, and Whyalla, in South Australia, with collieries, coke works, and quarries producing flux and refractory materials.

WESTERN AUSTRALIA

▶ The State Mining Engineer, in his report on mining operations during 1940, records that fatal accidents totaled 28 and serious accidents were 1,403, of which three fatal and 266 serious accidents occurred in coal mines and quarries. There is a decrease of 11 fatal, and an increase of eight serious accidents in the previous year. Of the 25 fatal accidents in gold mines, three were prospectors and 18 occurred in the principal mines. The number of serious accidents in gold mines—1,137—compares with 1,074 in 1939 and the number of men employed in such mines during the respective years was 14,594 and 15,216.

▶The Cox's Find mine, at Erlistoun, is held by Western Mining Corp., Ltd., with a 75 percent enterest and Central Gold, N. L., which owns 25 per cent. During the year ended March 25, 1941, 20,539 tons of ore was milled for a yield of 9,743 oz. of gold which realized £A95,492, equivalent to a yield of 9.49 dwt. per ton. Mining conditions were difficult due to the flattening of the orebody and the irregular shape of the oreshoots.

▶Kalgoorlie Enterprise Mines, Ltd., which is situated on the western side of the Boulder Perseverance and the South Kalgurli Consolidated mines, and north of the Great Boulder mine, was originally opened up by local interests some ten years ago and was the first effort toward a revival of interest in the Kalgoorlie field, outside the mines then operating, following the slump which prevailed some 12 years ago. A controlling interest in the mine was obtained by the Broken Hill Proprietary Co., Ltd., which formed Kalgoorlie Enterprise Mines, Ltd., in 1934, with a capital of £275,000. The Broken Hill Proprietary Co.'s interest was acquired by Boulder Perseverance, Ltd., which is general manager of the company, in 1936.

NEW BOOKS

LEAD MINES OF THE LOWER KENTUCKY RIVER VALLEY. *By Willard Rouse Jillson. Published by John P. Morton & Co., Louisville, Ky. Pp. 51, including 13 pages of annotated bibliographic references. Price $3.25.*

IN THIS VOLUME Dr. Jillson, former State Geologist of Kentucky and professor of geology at the University of Kentucky, presents an address delivered last year before the Kentucky Academy of Science and the Kentucky Geological Society. In summarizing his conclusions respecting the old district described, in Franklin, Henry, and Owen Counties, he states that the lead-zinc-barite veins are apparently of little mining significance at any appreciable height above the top of the Trenton or Lexington Series; that some of them probably extend below the 325-ft. depth of the present deepest shafts to 1,000 or 1,500 ft. beneath the surface; that they tend to maintain their width and that the galena and sphalerite tend to increase; and that, for mining to be successful, they should be worked for their entire metal content, including barite.

ELEMENTARY MATHEMATICS FOR ENGINEERS. *By Sir Ambrose Fleming. Published by Chemical Publishing Co., Inc., 234 King St., Brooklyn, N. Y. Pp. 110. Price $2.*

ALTHOUGH the title of the book used on flyleaf and cover is as given above, it appears immediately upon examining the text that the "engineers" for whom the author prepared the volume are electrical engineers, this being so stated at the top of each page. However, mathematics is mathematics, and the compilation and condensation of fundamentals will doubtless prove useful to many in other branches of engineering. The respective chapters cover algebra, plane trigonometry, plane coordinate geometry, vector algebra, differential calculus, integral calculus, differential equations, harmonic analysis, and hyperbolic trigonometry. Mathematical tables are appended.

THE MINERAL INDUSTRY DURING 1940. *Vol. 49. Edited by G. A. Roush, R. D. 3, Bethlehem, Pa. Published by McGraw-Hill Book Co., 330 West 42d St., New York. Pp. 778. Price $12.*

ESSENTIALLY UNCHANGED in its size and the subjects covered, the new volume of "Mineral Industry" makes its bow in the fall of the year following the one reviewed, as customary. At least eight months are necessary to collect "a reasonably complete cross-section of world data," the editor declares, and even then belated items continue to straggle in with every mail. This is the situation even in a normal year. This year, furthermore, the impact of the war makes itself felt in that receipt of certain data usually included has been interrupted or delayed. This is seemingly inevitable in any attempt to collect world statistics at such a time, and the user will doubtless make allowance for such shortcomings, frankly admitted, minor as they are in comparison with the great task so well accomplished.

The only change noted among the authors of the various chapters is the substitution of Prof. Roush's name for that of L. H. Tarring as the writer of the chapters on antimony and manganese, respectively, and of the chapter on mica, which previously was unsigned. The name of F. W. Hinrichs, university fellow in geology, Northwestern University, is now included in the list of contributors, though in what capacity is not stated.

▼ ▼ ▼

PUBLICATIONS

RECEIVED

The St. Lawrence Seaway—Part III. Potential Traffic on the St. Lawrence Seaway. U. S. Department of Commerce. For sale by Superintendent of Documents, Washington, D. C. Pp. 342. Price 40c.

Bulletin for editors of employee publications. Published by American Association of Industrial Editors, 1964 E. Ninth St., Cleveland, Ohio. June issue contains addresses delivered at annual convention.

New Mexico. Report of the State Inspector of Mines for year ended Oct. 31, 1940. State Bureau of Mines and Mineral Resources, Socorro, N. M. Pp. 21.

Argentina Minera. Organ of the Argentine Bureau of Mining. Vol. 1, No. 1. Pp. 8. Buenos Aires.

Spectrographic Analysis of Tin-Lead Solders. By D. M. Smith. Publication No. 5, Tin Research Institute. Office in the United States with Battelle Memorial Institute. Columbus, Ohio. Pp. 9. No price indicated.

Smithsonian Institution. Annual Report of Board of Regents for 1940. For sale by Superintendent of Documents, Washington, D. C. Price $1.50. This report, like its predecessors, is notable for the collection of highly interesting scientific (but not too technical) papers on varied subjects, in the appendix, which constitutes the bulk of the book.

Colorado. Annual Report of State Bureau of Mines for 1939. Bureau of Mines, State Capitol, Denver. Pp. 85. Contains list of operating mines.

South Dakota. Annual Report of Inspector of Mines for 1940. By H. H. Stewart, Deadwood, S. D. Pp. 50. Describes operating companies.

Tungsten Deposits of Arizona. Geological Series No. 14, Bulletin 148, Arizona Bureau of Mines, Tucson, Ariz. Pp. 54. Price 25c.

Saskatchewan. Annual Report of Supervisor of Mines for year ended April 30, Address is presumably Regina.

Ecuador. Mining and Petroleum in Ecuador. Annual report (in Spanish) of Director General of Mining and Petroleum for 1940. Quito, Ecuador. Pp. 205, plus 19 folded sheets of tables.

South Africa. "Industrial Minerals," April-June, 1941. Quarterly Information Circular, Department of Mines, Pretoria. Pp. 41.

Transvaal Chamber of Mines, Fiftieth annual report, for the year 1939. Also report for 1939 on work of Timber Research Laboratory. Johannesburg, Transvaal, S. A.

New South Wales. Mineral Resources Bulletin 38. Part I—The Gulgong Gold Field. Part II—Magnetic Prospecting of Gulgong Deep Leads. Pp. 168, plus separate maps. Price 9s. Also, Geology and Underground Water Resources of East Darling District. Pp. 80, plus maps. Price 6s. Department of Mines, Sydney, Australia.

Australasian Institute of Mining and Metallurgy. Proceedings, New Series, Nos. 120, 121, and 122. These paper-bound volumes contain, in addition to the Society's notes, 11 papers on the following topics respectively: Coated Gold from Cobar, New South Wales; Ore Deposits of Captain's Flat, New South Wales; Circular Tunneling (in Malaya); Note on Some Tantalum-Niobium Minerals from Western Australia; Controlling Factors in Assay of Silver by Cupellation; Deformation of Single Crystals of Lead by Creep—Parts II, III, and IV; Deformation by Creep of a Specimen of Lead Consisting of Five Large Crystals; Surface Plant at Zinc Corporation Mine, Broken Hill (with supplement of 18 folded drawings); and New Office and Changehouse Building at Zinc Corporation, Ltd., Broken Hill, N.S.W. (with nine supplementary drawings).

U. S. Geological Survey has issued the following (for sale by Superintendent of Documents, Washington, D. C., at stated prices):

"Past Lode-Gold Production from Alaska." Bulletin 917-C. Pp. 212. Price 10c.

"Tin-bearing Pegmatites of Tinton District, Lawrence County, South Dakota." Bulletin 922-T. Pages 595–630 inclusive. Bound with Bulletin 922, "Strategic Minerals Investigations 1940". Pp. 19. Price $1.

"Superposition in Interpretation of Two-Layer Earth-Resistivity Curves." Bulletin 927-A. Pp. 18, plus table and graph. Price 30c.

"Titanium Deposits of Nelson and Amherst Counties, Virginia." Professional Paper 198. Pp. 38, plus 19 plates. Price 25c.

"Bureau of Mines, Washington, D. C., has issued the following (no charge is made):

R. I. 3578: "Softening Water With Non-metallic Minerals." Pp. 18.

R. I. 3581: "National Safety Competition, 1940." Pp. 37, plus report blanks.

R. I. 3582: Progress Reports—Metallurgical Division. "Ferromanganese-Grade Concentrates From Cuyuna Range." Pp. 14.

Dominion Department of Mines and Resources, Ottawa, Mines and Geology Branch, has issued the following, at stated price:

Mineral Industry of the Northwest Territories. Geological Survey Memoir 230. Pp. 130. Price 50c.

Paleozoic Geology of Brantford Area, Ontario. Geological Survey Memoir 226. Pp. 176, plus maps. Price 50c.

Jacquet River and Tetagouche River Map-Areas, New Brunswick. Geological Survey Memoir 227. Pp. 46, plus maps. Price 25c.

Houston Map-Area, British Columbia (18-pp. report and map). Geological Survey Paper 40–18. Price 10c.

Manson Creek, British Columbia (map only). Geological Survey Paper 41-5. Price 10c.

Vassan-Dubuisson Map-Area, Abitibi County, Quebec (9 pp. summary account and map). Geological Survey Paper 41-6. Price 10c.

Northeast Part, Beauchastel Township, Temiscamingue County, Quebec (5 pp. summary account and map). Geological Survey Paper 41-7. Price 10c.

Dominion Bureau of Statistics, Ottawa, Canada, has issued the following, the price being as stated in each case:

"Annual Report on Mineral Production of Canada, 1939." Pp. 272. Price 50c.

"Nickel-Copper Mining, Smelting and Refining Industry in Canada, 1940." Pages 10. Price 25c.

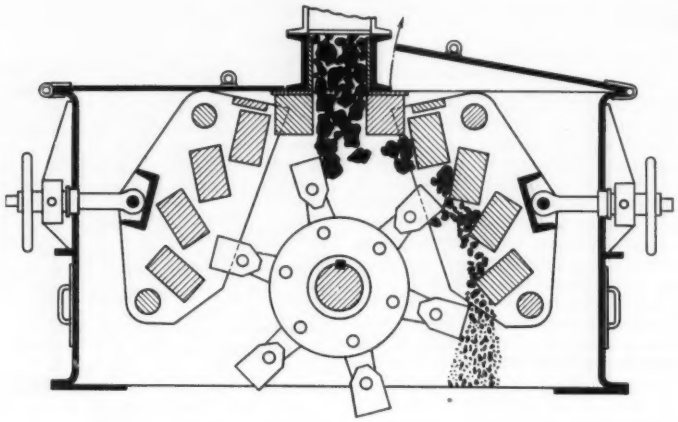
"Salt Industry in Canada, 1940." Pp. 9. Price 25c.

The Talc and Soapstone Industry, 1940 (Canada). Pp. 6, price 25c.

Silver Mining Industry in Canada, 1940. Pp. 25, price 25c.

EQUIPMENT NEWS

Impact Crusher



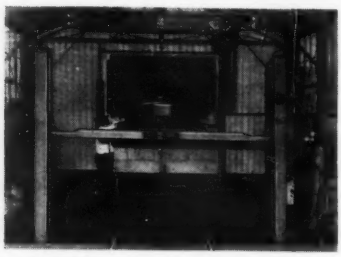
AN IMPROVED IMPACT CRUSHER was recently announced by the Pennsylvania Crusher Co., Liberty Trust Building, Philadelphia, Pa. Known as the Impactor, the cruser is said to perform its work by high velocity impact-batting, driving the feed against a series of adjustable anvils that have working clearances varying from 3 to 6 in. There is said to be no cage to set up attrition wear.

The feed, as shown in the sketch, enters centrally and directly over the rotor. The height of the feed-chute is proportioned so the ore drops well in front of the impact-beaters. A hard blow in mid-air projects the ore violently against the top anvil. Smaller pieces escape below, while the anvil deflects the larger pieces back into the orbit of the oncoming hammer. This crushing cycle is said to be very effective, as the applied energy is rapidly absorbed in shattering the feed by direct reduction impacts. In general, the feeds range from from ¼ in. to 6 in., and in some cases up to 10 in., with the finished product ranging from ¾ in. to minus-100 mesh, depending on kind and size of feed and fineness desired. Rock 6 to 10 in. in size is said to be reduced by the Impactor in closed circuit to minus ¼ or ⅛ in., and smaller. As attrition or rubbing is said to be eliminated, power consumption is reduced.

An exclusive feature of this unit is said to be its operating advantage of reversible crushing—that is, the anvils are located symmetrically about the central rotor so that right or left hand rotation is possible by throwing a reversible switch, affording longer life for the crusher. The frame is heavily fabricated from rolled plates and shapes. The rotor shaft is forged and heat-treated similar to locomotive driving axles and the anvil adjustment is simple and quick. Sizes of this type crusher range from 5 to 150 tons per hour and speed ranges from 300 to 1,200 r.p.m.

Electric Lift for Mine Car Service

AN ELECTRIC-POWERED LIFT raising a section of track bearing a mine car has simplified the work of servicing mine cars to a considerable extent, according to engineers of the Globe Hoist Co., Philadelphia, Pa., manufacturers of the lifting device. Power is supplied by an electric motor driving the gear mechanism in each of the four corner posts and protected by an exclusive automatic brake feature which prevents the lift of superstructure from dropping. The lift is said to raise the mine car quickly to a convenient working height of about 5 ft. 10 in., and is said in some instances to have permitted a 50 percent reduction in time required to service and repair the cars.



New Type of Neoprene

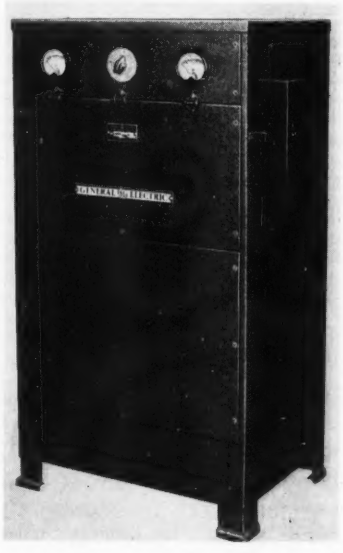
A NEW TYPE of neoprene synthetic rubber that is said to withstand the effects of sub-zero temperatures better than any other types of neoprene was announced recently to the American Chemical Society by D. F. Frazer and F. L. Yerzley, of the du Pont Co., Wilmington, Del. Called neoprene Type FR, it is said to combine the desirable qualities of natural rubber at low temperatures and the oil-resistant qualities and characteristics of all types of neoprene. The vulcanizates of neoprene Type FR are said to be more resilient, take lower compression set, and have greater resistance to swelling by water than other types of neoprene. It is supplied in the form of pre-plasticized, milled sheets and is said to have lower specific gravity than any other neoprene.

Jump-Over Rail Switches

A DEVICE for providing temporary jump-over switches in mine haulageways has recently been introduced by the Portable Lamp & Equipment Co., 78 First Ave., Pittsburgh, Pa. When the device is employed, man-hours ordinarily necessary for installing a switch are said to be often reduced more than half, because it is unnecessary to cut main track. The equipment consists of two turnout castings and a frog casting that are hinged to base members which in turn are bolted to rails. This permits the units to be hinged on or off the rails as required. Two combinations are available corresponding to conventional switch with No. 2 and No. 4 frogs. Base members are said to be easily attached to the rails by means of standard track bolts.

Improved Chargers for Electric Batteries

AN IMPROVED LINE of fan-cooled copper-oxide battery chargers for charging 12-, 15-, or 18-cell electric truck lead batteries, or 16- to 24-cell Edison type batteries, right where they are used, has been announced by the General Electric Co., Bridgeport, Conn. They operate with a high starting rate which is automatically reduced to a safe finishing rate when the battery reaches approximately 80 to 85 percent of complete charge.



These improved chargers can be installed easily anywhere in the operating territory of the trucks when 3-phase a.c. power is available. They are said to save time when trucks must be run to

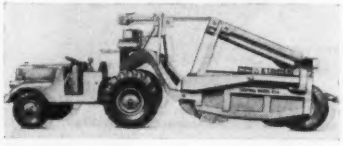
and from a central charging station at a remote point. Noon-hour boosts can also be given to batteries. The chargers are said to occupy less than 3 sq.ft. of floor space, require no base or mounting bolts, and can be readily transferred to another point when desired.

Operation of these chargers is simple. After initial adjustment is permanently made by the maintenance electrician, the truck operator merely plugs in the battery and turns on the starting button, which performs the dual function of starting the rectifier and presetting the timing of the finishing charge. There are no other external controls. Safety features are provided. If for any reason the ventilating fan stops, an air-operated switch opens the control circuit and stops the rectifiers.

Two models of the copper-oxide battery charger are designed for charging lead batteries. Model 6RC121F1, here illustrated, operates on 220 volts, 3 phase, 60 cycles. Model 6RC121F2 is for 440 volts, 3 phase, 60 cycles. Both models are identical in output rating. The high rate can be adjusted from 100 amp. maximum down to 50 amp. minimum. The finishing rate can be adjusted for 25 to 30 percent of the high rate setting. Two other models, 6RC121F3 and 6RC121F4, are available for charging Edison type batteries. The output adjustment will provide 100 amp. maximum down to 50 amp. minimum and covers a range of 16 to 24 Edison type cells.

Scraper

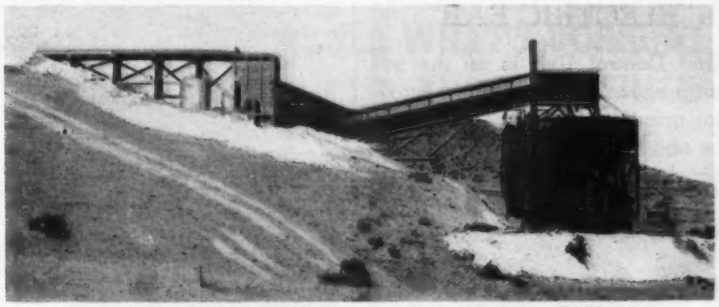
R. G. LETOURNEAU, INC., Peoria, Ill., announces the Model DLS Carryall Scraper, with a rated capacity of 8½ cu.yd. struck and 11 heaped yards, for use with a new Caterpillar four-wheel



tractor. The cutting edge is 8 ft. 6 in. With the apron cable deadened on the apron, all hoist and unloading cables are now placed up and out of the dirt, eliminating abrasive cable wear. The unit is operated by cable from a standard power unit especially adapted for use with the new caterpillar tractor.

Core Drill

A NEW HEAVY-DUTY CORE DRILL, known as the 27-HD, is announced by the Sullivan Machinery Co., Michigan City, Ind. It is adaptable for mineral prospecting or testing foundations for heavy construction. The unit is rated at 1750 ft. capacity with size "E" rods. The drill is a direct-drive machine with power unit connected with the drilling head through the four-speed auto motor type transmission by means of a clutch. The built-in clutch allows the use of any power unit having a stub shaft (electric, gasoline, or diesel) if operating characteristics are suitable. The swivel head, large hoisting drum, transmission, clutch,



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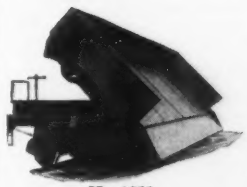
WRITE for complete information on recommended types for your service. Request Bulletin No. 71.



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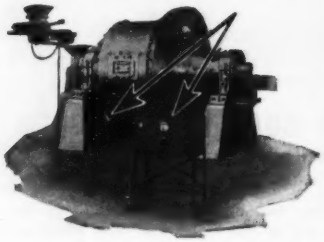
Sound Control Unit is on the job continuously, maintaining maximum grinding capacity, hour after hour and day after day. It has no other duties to perform.



Bulletin 42

HARDINGE
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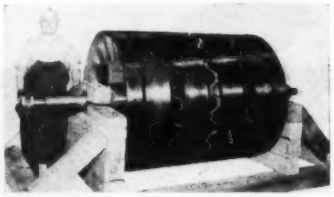
and power unit are mounted on a rigid skid base and can be quickly dismantled into four main parts for mule-back transportation.

Hydraulic Vise

A NEW HYDRAULIC VISE, said to offer savings in time and labor, has been introduced by the Studebaker Machine Co., 9 South Clinton St., Chicago, Ill. It is said to be capable of developing

New Studebaker Hydraulic Vise showing vise, ram, tubing, and floor pedestal unit. Foot control frees hands, speeds vise work.

pressures up to 5 tons between the jaws and is designed to speed up small press and cutting operations, as well as ordinary vise work. The unit is operated entirely by foot control, permitting the use of both hands in setting up and removing work. Stepping on one pedal moves the vise jaw to contact against the work. A second pedal applies pressure up to 5 tons. A third pedal releases the jaw. Two sizes are available—5 in. width between jaws and 7½ in. width.



This is reported to be the largest commercial magnetic pulley ever built. It measures 48 in. in diameter and 63 in. face width and weighs 18,000 lb. Made by the Dings Magnetic Separator Co., Milwaukee, Wis., it is of high intensity serrated air-cooled design, incorporating radial and longitudinal ducts

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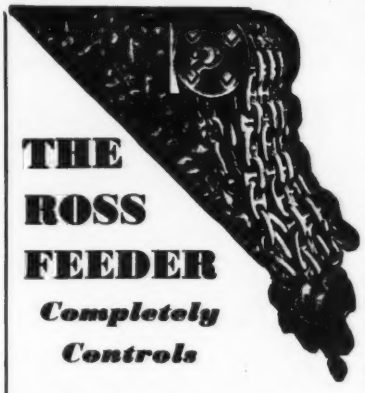

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Underground loading of gypsum at the mine of the National Gypsum Co., Sun City, Kan., is facilitated by a Model T. Traxcavator of the Trackson Co., Milwaukee, Wis. The machine handles about 35 tons of rock per hour

Self-Aligning Idler

A SWIVELING, positive self-aligning idler for automatically correcting misalignment of either carrying or return runs of non-reversing conveyor belts supported on flat roll idlers is announced by Link Belt Co., Indianapolis, Ind. The new unit is said to have a centrally pivoted cross member, which, besides being equipped with a flat idler roll for supporting the belt, has a vertically mounted actuating roll at each end for lightly contacting the edge of the belt when its lateral misalignment exceeds a pre-determined amount. A slight pressure of the belt edge against the actuating roll is said to swivel the idler on its pivot sufficiently to guide the belt automatically back to proper alignment.

A new eyeguard said to be light and strong and molded entirely of clear plastic is announced by B. F. McDonald Co., 1248 South Hope St., Los Angeles, Calif. The unique design of the guard eliminates pressure on the ears or on the bridge of the nose

Single-Filter Respirator

A NEW AND IMPROVED single-filter respirator, called the Dustfoe, was recently announced by Mines Safety Appliances Co., Pittsburgh, Pa. The new device replaces the two-part (felt screen and cellulose) filter used previously. All in one piece, the new unit is said to give a U. S. Bureau of Mines-approved protection against an even broader range of dusts and mists. It is said to be more porous on the outer side so that larger dust particles are filtered out first, thus preventing build-up of breathing resistance through clogging of filter.

Correction. A typographical error appeared in the caption under the photograph at the top of page 102 in our October issue. The corrected portion of the caption is "Three sizes of screw classifiers of the Western Machinery Co., San Francisco, Calif."

BULLETINS

Insulating Concrete. Atlas Lumnite Cement Co., Chrysler Building, New York City. The company has issued an interesting mimeographed bulletin stressing the availability of materials and the adaptability of refractory insulating concrete for industrial furnace construction. Six charts give hot- and cold-face temperatures and heat loss for different thicknesses of several types of furnace walls at operating temperatures from 250 deg. to 2,500 deg. F. Pp. 14.

Heat Controls. Weltronic Corp., 3080 E. Outer Drive, Detroit, Mich. Bulletin S-41 describes the manufacturer's line of heat controls, synchronous timers, and machine controls for welding purposes. Pp. 4.

"Stellited Rock Drill Parts" is the title of a folder issued by the American Pneumatic Tool Co., 2143 Bay St., Los Angeles, Calif., describing company's process of applying hard-facing materials to rock drill parts. Pp. 4.

Mineralight. Ultraviolet Products, Inc., 5205 Santa Monica Boulevard, Los Angeles, Calif. Catalog 30-M describes and illustrates features of the manufacturer's fluorescent and ultraviolet ray lamps. Pp. 4.

Crushers. Straub Manufacturing Co., 504 Chestnut St., Oakland, Calif. Bulletin 39 describes and illustrates installations of the manufacturer's line of crushers. Pp. 4. Bulletin 601 describes and illustrates crushing principles of the manufacturer's Kue-Ken crusher unit. Pp. 8.

Jackbits. Ingersoll-Rand Co., 11 Broadway, New York City. Form 2780 describes and illustrates the manufacturer's range of sizes and types of detachable drill bits. Pp. 24.

Tunneloader. Eimco Corp., Salt Lake City, Utah. Bulletin 106 describes the company's new Model 40 tunneloader for cleaning out large drifts and tunnels. Pp. 4.

YOU wouldn't know the old diggings since the old man sent for those Southwestern Engineering Company bulletins. They gave him ideas about speeding up production to meet defense demands. He found good ideas in jigs, flotation machines, ball mills and ore feeders, sand and diaphragm pumps, conditioners, agitators and thickeners, automatic samplers and factory built pilot plants. We've gone modern with Southwestern equipment. Pass the word to mining men in your outfit to send for Bulletin No. 402.

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ENGINEERING & NERCO RESEARCH CORP.
60 WALL TOWER, NEW YORK, N. Y. — UNIVERSITY TOWER, MONTREAL, P. Q.

Diesel Engines. National Supply Co., Springfield, Ohio. Bulletin 135 describes the manufacturer's 8½x10½ stationary diesel engines for various industrial uses. Pp. 10. Bulletin 137 describes the company's 12x15 stationary diesel engines for various industrial uses. Pp. 12.

Respirator. Mine Safety Appliances Co., Pittsburgh, Pa. Leaflet CM-5 describes the new and improved M.S.A. Single Filter Dustfoe Respirator. Pp. 2.

Power Shovel. Bucyrus-Erie Co., S. Milwaukee, Wis. Bulletin 54B-4 describes and illustrates features of the manufacturer's new 54-B diesel-operated shovel.

Self-Locking Nuts. Elastic Stop Nut Corp., 2330 Vauxhall Road, Union, N. J. Leaflet 41-23 describes the manufacturer's line of self-locking nuts. Pp. 4.

Centralized Lubrication. Farvall Corp., 3293 E. 80th St., Cleveland, Ohio. Form 167 describes and illustrates features of the company's Farvall centralized system of lubrication. Pp. 7.

Pressure Gage Accessories. Brown Instrument Co., Philadelphia, Pa. Catalog 6706-A describes the company's line of thermometer and pressure-gage accessories. Pp. 24.

Transformers. Sola Electric Co., 2525 Clybourne Ave., Chicago, Ill. Bulletin CV-74 describes the company's line of constant-voltage transformers. Pp. 22.

Concentrating Table. Deister Concentrator Co., Ft. Wayne, Ind. Bulletin 118 describes the company's super-duty diagonal-deck No. 6 concentrating table. Pp. 4.

Bulldozers. Baker Mfg. Co., Springfield, Ill. Bulletin 834 describes and illustrates the company's line of bulldozers equipped with direct hydraulic lift. Pp. 25.

Jaw Crushers. Alloy Steel & Metals Co., 1862 E. 55th St., Los Angeles, Calif. Bulletin 116 describes the manufacturer's 15x28-in. and 15x38-in. jaw crushers. Pp. 4.

Detachable Bits. Hayes Steel Products, Ltd., Merritton, Ontario, Canada. Catalog describes and illustrates features of the Hayes detachable rock drill bit and reconditioning methods employed in drill-sharpening and reconditioning of bits and shanks. The book is attractively illustrated and contains engineering drawings and data for equipment in machine-shop layout. Pp. 48.

Sheaves. Allis Chalmers Mfg. Co., Milwaukee, Wis. Bulletin 6047 describes and illustrates the company's steel and cast-iron sheaves for Tex-rope drives from fractional to 25 hp. Pp. 11.

Annealing Nickel, Monel and Inconel. International Nickel Co., Inc., 67 Wall St., New York City. The development and research division of the company has released bulletin T-20 on the subject-matter mentioned.

Mine-Car Loaders. Sullivan Machinery Co., Michigan City, Ind. Bulletin describes and illustrates the company's line of mine-car loaders. Features of the units are described in detail and operating technique is well illustrated. Underground layout drawings are shown for servicing loaders with empty cars. Pp. 19. **Self-Rotating Stoper.** Bulletin A-7W describes and illustrates features of the company's S-91 self-rotating stoper. Pp. 6. **Core Drill.** Bulletin D-21 describes the new light-weight Sullivan No. 12 core drill. Pp. 7. **Safe-T-Stoper.** Bulletin describes and illustrates the company's stoper drill that features safety in operation. Pp. 10. Bulletin D-25 describes features of the No. 6 one-man Sullivan diamond core drill. Pp. 4.

Log Washers. Eagle Iron Works, Des Moines, Iowa. Bulletin 41 describes and illustrates features of the company's line of spiral-screw and paddle-type log washers. Specifications and general dimensions of various sizes of equipment are included. Pp. 28.

INDUSTRIAL NOTES

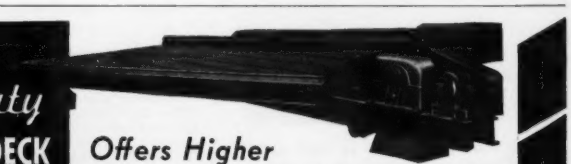
Diversification, which has always been the most striking characteristic of the chemical industries, has been greatly stimulated by the new demands created by the war and the national defense program. This will render more significant than ever before the revelations at the **18th Exposition of Chemical Industries,** which is to be held in Grand Central Palace, New York City, Dec. 1-6.

Top award in the Industrial Classification of the **Sixth Annual Modern Plastics Competition** went to the **Oliver United Filter Corp.,** Oakland, Calif., for its Acid Pump Impeller and Filter Drum Segment. The pump impeller, molded by the American Molding Co. on a Dunning & Boschert press of Durez Plastics and chemical materials, has achieved higher pumping efficiency, longer life, and a weight reduction of approximately 75 percent—all through the use of plastic materials. The Filter Drum Segment made from Bakelite Corp. materials is assured of a longer life because of corrosion resistance, reduction of cost because of elimination of all machine work, and considerable saving in weight. The maintenance of uniformity of segments guarantees the intended open areas and results in improved filter efficiency.

Louis B. Neumiller, who began his association with Caterpillar Tractor Co. of Peoria, Ill., 26 years ago, in the engineering department, has been elected president of the company by the board of directors. Mr. Neumiller succeeds B. C. Heacock, president since 1930, who becomes chairman of the executive committee.

The **Pioneer Engineering Works,** of Minneapolis, Minn., manufacturers of mine, quarry, and gravel pit machinery, announce the recent appointment of **The E. F. Craven Co.** of Greensboro, N. C. is the new distributor for the State of North Carolina, and **James Ray Norton** for New York State, with address at 11 West 42d St., New York City.

Super Duty
DIAGONAL DECK
No. 6
CONCENTRATOR TABLE
DEISTER DIAGONAL DECK OVERSTROM



Offers Higher Capacity and makes a Higher Grade Concentrate . . .

Improved "fanning out" action of the Diagonal Deck —the new record making Concenco Anti-Friction Head Motion—smooth and easy running—account for unsurpassed recovery on more actual tons of new feed per day.

Write for Bulletin No. 118.

THE DEISTER CONCENTRATOR COMPANY
The Original Deister Co., Incorporated 1906
903 Glasgow Ave. Ft. Wayne, Ind., U. S. A.